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GEOGRAPHICAL PATHOLOGY.

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GEOGRAPHICAL PATHOLOGY:

AN INQUIRY INTO THE GEOGRAPHICAL DISTRIBUTION OF INFECTIVE AND CLIMATIC DISEASES.

BY

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*SOUTH-EASTERN ASIA, INDIAN ARCHIPELAGO,
AUSTRALIA AND POLYNESIA, AFRICA,
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GEOGRAPHICAL PATHOLOGY.

ASIA.

DIVISION III.

SOUTH-WESTERN ASIA, INDIAN ARCHIPELAGO, AUSTRALIA, AND POLYNESIA.

CHAPTER I.

MALAYAN PENINSULA AND SINGAPORE.

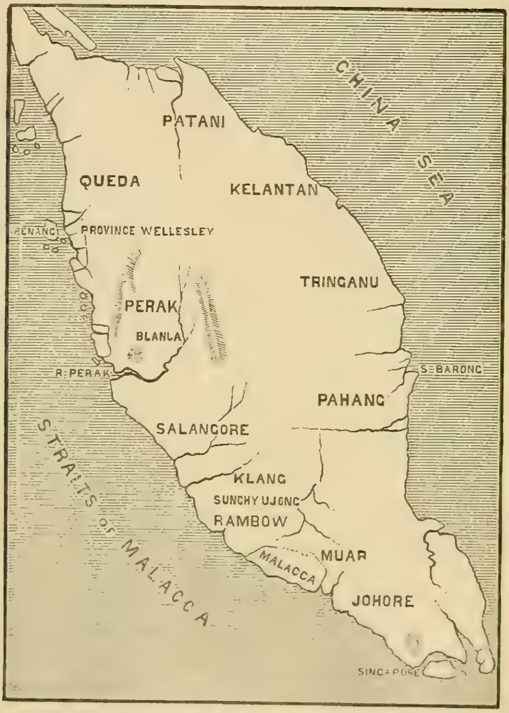
GEOGRAPHY. — The Malayan Peninsula may be considered as stretching from the northern extremity of the Gulf of Siam, southwards, for about 900 miles, to Singapore. Its greatest breadth is about 210 miles; at the Kra isthmus it narrows to 44 miles. Of the north-eastern portion of the peninsula, washed by the Gulf of Siam, little is known: the north-western region forms the province of Tenasserim, which has already been noticed.

The English possessions comprise the island of Penang, the province of Wellesley on the adjoining mainland, a small settlement at Perak, the province of Malacca, and the island of Singapore.

A range of hills, more or less continuous, traverses the centre of the peninsula from north to south. The western coast belt in many places abounds in swamps, jungles, and rice fields (*Army Medical Report*, 1876). Of the interior, and, we may add, of the east coast, little is known.

The comparative immunity of Singapore from malarial fever has long been known. Dr. Macculloch, in 1827, says that Singapore "is a collection of jungles and woods, and marshes and rivers and sea swamps; and it is a flat land under a tropical sun; and it is the land of monsoons; and yet it is a land where fevers are unknown." This, he says, "is a mystery for which I can conjecture no solution." Dr. Johnson, in dealing with this extract (*Med. and Chir. Rev.* vol. viii. 1821), says that he can relieve the author (Dr. Macculloch) from his dilemma. "Singapore," he says, "is not a collection of jungles, woods, marshes, rivers, and sea swamps, but a cluster of rocky islands in the midst of an azure sea, and under a sky seldom darkened by a cloud. There are no marshes or swamps in the neighbourhood, and the change of monsoons is not marked by those storms and tornadoes which occur in other parts of India." Such are the conflicting opinions of these two authorities. The following particulars, for which I am indebted to Dr. Rowell, the chief medical officer of the colony, will enable us to judge for ourselves what Singapore is like.

The island is 25 miles in length and some 14 miles in breadth. The town is built on an alluvial soil, with a covering of vegetable mould. The banks are raised from 5 to 10 feet above the level of the high-water spring tides, and as the plain extends towards the higher rising ground, the soil is composed of red tenacious clay. The suburbs to the north and west of the town consist of a series of almost parallel ridges and hillocks, ranging from 50 to 120 feet high, on which are to be seen the residences of the wealthier portion of the European community, including the European regiment located in this station. On one of the nearest of these eminences Fort Canning is built, and is occupied by a detachment of artillery.



MALAYAN PENINSULA.

The country may be said to commence at about a distance of three miles from the town. Here we come upon a series of hilly ridges, forming in some places prominent peaks, the highest of which, Buckit Timah, is about the centre of the island, and attains the height of 500 feet. Narrow swampy valleys penetrate between the spurs and offshoots of the main ridges. These seldom attain any great elevation above the level of the sea, of which they had originally, perhaps, formed arms or inlets. The sponginess of the decayed vegetation, consisting of a variety of ferns and mosses covering these valleys, combined with their flatness, assists much in retaining the rain-brought moisture. The hilly portions are covered with forest trees and much undergrowth.

The mouths of the smaller rivers are all more or less fringed with mangrove swamps.

The country districts are very sparsely populated. Of these Mandai is the only one which sends in any large number of cases of fever. This is said to be owing to the proximity of the station to the thicker parts of the forest; but, in Dr. Rowell's opinion, it is more likely to be owing to the cutting down of the jungle always going on in the neighbourhood.

On one or two of the islands situated at the entrance of the new harbour, fever of an intermittent type is more or less prevalent, and is supposed to arise from the sun's action at low water on the coral beds which exist there.

Most readers will probably think that Dr. Maculloch's description of Singapore, although somewhat exaggerated, is nearer to the truth than that of the reviewer.

CLIMATOLOGY.—The following table gives the mean temperature of the island of Penang, of the town of Malacca and of Singapore, for the year 1883, the average rainfall of Penang and Malacca for the years 1880–83, and of Singapore for nine years. The daily range of temperature for Singapore for 1883 is added:—

	PENANG.		MALACCA.		SINGAPORE.		
	Mean Temperature 1883.	Rainfall 1880–83.	Mean Temperature 1883.	Rainfall 1880–83.	Mean Temperature 1883.	Rainfall Average of Nine Years.	Daily Range.
January, .	81·9	3·60	80·4	3·17	79·4	6·27	15·0
February,	82·2	1·42	81·6	4·83	80·4	5·88	16·1
March, .	82·5	6·82	81·7	5·06	81·4	6·93	15·6
April, . .	82·7	7·94	81·3	4·50	82·1	6·58	14·3
May, . .	82·8	11·23	83·8	8·12	82·9	5·62	14·3
June, . .	83·7	4·53	82·6	6·86	82·2	7·84	14·1
July, . .	81·8	8·27	81·8	4·83	83·1	5·96	14·5
August, .	83·3	10·08	82·0	12·14	83·0	8·42	14·5
September,	80·4	14·01	81·1	12·90	81·5	7·52	14·2
October, .	81·6	18·80	80·6	10·90	80·5	7·70	13·4
November,	80·2	11·49	79·6	11·09	80·2	11·14	12·7
December,	80·8	6·39	80·3	8·26	79·0	10·53	14·1
Totals and Means, .	82·0	104·58	81·4	92·66	81·3	90·39	14·4

The climate is thus marked by a high but equable temperature and by a heavy rainfall, without any completely dry season.

PATHOLOGY.—*Malaria.*—Dr. Rowell states that "the island is remarkably healthy, being comparatively free from fevers of all kinds, and marked for the mildness of type of all diseases known as tropical."

The Straits Settlements, taken as a whole, are wonderfully free from malarious diseases. In the year 1882, 15,111 patients were treated at the hospitals in all the Settlements. Of these only 7·4 per cent. suffered from intermittent, and 1·1 per cent. from remittent fever.

In Province Wellesley, the fever admissions amounted to 9·2 per cent. of the total, and the dysentery admissions to 3·1 per cent.

At the Singapore Pauper Hospital, in 1882, intermittent fever formed 9 per cent., and remittent fever 1·5 per cent. of the total admissions, and it is said that this was an unusually malarious year. At Sunghie-Ujong, according to M'Namara, the natives suffer to a considerable extent from fever.[1] The malarial infection seems to manifest itself in the Malayan Peninsula rather in causing anæmia and debility than in febrile phenomena.

It must not be supposed, however, that fever of a more severe type is never seen in the Malayan Peninsula.

It is noticed in the *Medical Report* for 1882, that a large number of cases of remittent and intermittent fever occurred in that year on an estate in Wellesley, and that 18 out of 32 persons suffering from remittent fever died.

It is stated by Dr. Potocnik that when the Prussian transport *Elbe* went into the harbour of Singapore in 1860 for repairs, the half of the crew were attacked with fever, which reigned in Singapore that season.

At Penang, in 1872, we read that 9 out of 150 men, including 5 officers, belonging to the 80th Regiment, had died of fever within five months, and the greater part of the detachment were in hospital with symptoms of malarial poisoning. Dr. Potocnik attributes this outbreak to the low elevation of the spot, the numerous works causing disturbance of the soil, the neighbourhood of rice fields, and the luxuriant vegetation.[2]

The disturbance of the swampy soil near the harbour at Singapore has always been followed by an increase of fever. The fever met with at Singapore is generally of the quotidian type, but tertians are occasionally observed.

[1] *Army Medical Report*, 1875.

[2] Potocnik, *Arch. de méd. navale*, vol. xxiv.

Typhoid Fever is excessively rare in Singapore; the few doubtful cases that have been observed have been in persons who have come from the adjoining mainland. In the hospital reports that have come under my notice, no mention is made of its occurrence in the other Straits Settlements.

Dysentery of a mild type furnishes about 31 per 1000 admissions into the hospitals. The disease seems to be rather more fatal among the Europeans. It was certainly one of the principal diseases affecting the troops in the Perak campaign.

Diarrhœa, on the other hand, is one of the chief causes of admissions and deaths in the hospitals of the Straits Settlements. Davie and M'Namara signalise its prevalence amongst the natives of Perak and Sunghie-Ujong.[1]

A disease known as *Sprue* is frequently met with. It is characterised by a sore, raw, red-edged, aphthous tongue, by chronic pultaceous diarrhœa and general wasting, and is complicated with interstitial change in the substance of the liver (Rowell).

Cholera is to be regarded only as an occasional visitor of the Settlements.

Smallpox is frequently epidemic among the natives, many of whom bear marks of the disease. I have met with no accounts either of *Measles* or of *Scarlatina* in this region, although the former is doubtless not unknown.

Diseases of the Respiratory System are very rare throughout the Settlements. Of 15,116 admissions into the Civil Hospitals in 1882, only 224 were for this class of diseases; and out of 1127 deaths, 11 only were caused by diseases of the respiratory organs. The deaths from pneumonia seem to cause about 1 per cent. of the hospital deaths.

Phthisis occupies a very subordinate place in the pathology of the Straits. Of 55 deaths occurring in the Prison Hospital of Singapore in 1882, only 3 are ascribed to consumption.

Scrofula is common amongst the natives of Perak.

Beriberi is very common throughout the Settlements, and has more than once been epidemic in the prisons.

Chronic Rheumatism is of frequent occurrence among the natives. The acute form of the disease appears to be rare.

Ulcers of all kinds — especially sloughing phagedena — are excessively common.

Anæmia and *General Dropsy*, with debility, are amongst the affections most generally met with among the native races.

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[1] Davie, "Med. History of Laroot Field Force," *Army Medical Report*, 1876. M'Namara on Sunghie-Ujong, *Army Medical Report*, 1875.

CHAPTER II.

INDO-CHINA.—SIAM, CAMBODIA, COCHIN CHINA, TONKIN.

GEOGRAPHY AND CLIMATE.—Siam is bounded on the south by the Gulf of Siam, the Malayan Peninsula, and Cambodia. On the north is Upper Burma; but the boundary, which is supposed to be about 20° N. lat., is ill defined. On the east it is bounded by Annam, and on the west by Burma. The population is estimated at about 7,000,000. The northern districts are mountainous, but the greater part of the country may be described as a vast plain, watered by the Menam and its tributaries. The Menam opens into the Gulf of Siam by three mouths about 18 miles below Bankok. The success or failure of the rice crops, in a considerable part of Siam, depends upon the annual overflow of the Menam, which commences in June and abates in October and November. The area inundated by this river is estimated at 12,000 square miles. The Mekong flows through Siam near the Annam frontier before entering Cambodia, and derives numerous tributaries from the eastern part of Siam. The mean temperature of Bankok, the capital, is 81° F. The maximum is 97° and the minimum 54°. The rainy season is that of the south-west monsoon, from April to November. The temperature is liable to great variations. Friedel found, in January, that he awoke chattering with cold about three o'clock in the morning.

PATHOLOGY.—*Malaria* prevails to a large extent both in the lower valley of the Menam and in the interior. Dr. Potocnik states that the fevers are mild in the well-cultivated districts, but that in the forests malaria rages with great intensity.[1] A choleriform malarial fever amenable to quinine is often met with at Bankok.

Typhoid Fever.—Hitherto we have met with no accounts of the occurrence of typhoid fever in Siam; but when the diseases of the country come to be more carefully studied, we may confidently expect that this disease will be found to be quite as common in Siam as in other parts of the east.

Dysentery is reported by Potocnik to be common and severe in

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[1] *Archiv. de méd. nav.* 1875.

Bankok, and in this he agrees with those who had before written on the diseases of this city; but to what extent dysentery prevails outside the capital and in the interior is unknown.

Diarrhœa takes a leading place among the diseases of natives in Bankok.

Cholera has repeatedly broken out in Siam, which was invaded for the first time in 1819. Lombard informs us that the disease broke out again in 1822; that in June 1849 it appeared once more, and carried off 30,000 of the inhabitants of the capital, and that during the first twelve days of its progress it made no fewer than 20,000 victims. But this is by no means a complete record of these invasions. It is probable that Siam has suffered during the following years, when the disease was prevalent in the far east, viz. 1830, 1842, 1852, 1856, 1860, and 1864. Bankok is described by Lombard as "un véritable foyer de choléra."

Bronchitis is common both amongst the natives and strangers.

Phthisis is stated to be seldom seen amongst the natives; but it would appear that when it manifests itself, whether in the native or in the European resident, it usually runs a rapid course.

Leprosy is not unknown in Siam; but we have no information as to its prevalence or distribution.

Syphilis is common at Bankok, which is not to be wondered at, seeing that it is the resort of sailors of all races. We have met with no accounts as to its frequency amongst the natives in the interior.

CAMBODIA AND FRENCH COCHIN CHINA.

GEOGRAPHY AND CLIMATE.—Cambodia and French Cochin China are bounded on the north by Siam, on the south by the China Sea, on the east by Annam, and in the west by the Gulf of Siam. It is a level country traversed by the Mekong (Ma-Kiang) river, which here forms an extensive delta covering a great part of French Cochin China. In the east is the Dong-nai and Saïgon rivers, with smaller streams which are connected with each other, and with the Mekong by innumerable canals. The delta is very fertile; the soil is porous, composed of sand mixed with clay. Rice is extensively cultivated, and two crops are raised in a year. The interior contains vast forests. Saïgon, the capital of the French settlements, and Vinh-Long, another town of some importance, are both situated in the delta. The rainy season, from April to October, has a mean temperature varying between 68° and 86° F.; the dry season, from October to April, has a temperature varying from 95° F. by day to 62° F. by night.

PATHOLOGY. — *Malaria.* — Beaufils remarks that the paludal infection cannot fail to maintain an imperious hold over a people that live in the midst of mud and marshes.[1] Simple intermittent, ordinarily of the tertian type, sometimes quotidian or subintrant, is frequently met with. Malarious diseases form a third of the admissions into the public hospitals; anæmia and malarial cachexia are common; the quotidian type is most common among the Europeans, the tertian among the natives; pernicious fevers are rarer among the natives than among the Europeans. No part of lower Cochin China is exempt from malaria. Bilious fevers are rather common among Europeans, less so among the natives, and are especially met with at the beginning of the rainy season.

The typhus du bois, or forest typhoid, is nothing else than jungle fever. It is frequent in the interior during the rainy season, even in those elevated wooded districts where rice is not cultivated.

Typhoid Fever is widely endemic in Cochin China, affecting not the French troops and foreign residents only, but also the natives in all parts of the country. The disease is not only frequent, but is often observed to be of a severe or malignant type. Of 342 cases treated by the French surgeons, 126, or about 37 per cent., proved fatal.

Diphtheria was epidemic in 1864 among the troops stationed at Tong-Keon. I am not aware whether it is endemic in the colony.

Cholera appears to be frequently epidemic in Cochin China. In 1862, cholera caused 18·9 per cent. of the total deaths; in 1863 the ratio fell to 13·0; in 1864 it rose to 19 per cent.; and, according to Lombard, from whom I take these figures, "these three years were not exceptional" as regards the mortality caused by cholera.

Dysentery is of frequent occurrence; it is persistent, recurrent, not unfrequently intermittent, and extremely dangerous. No less than "half the deaths among the French troops in Saïgon are due to dysentery and diarrhœa" (Hirsch). Diarrhœa is ascribed by Normand to the presence in the intestinal canal[2] of the *anguillula stercoralis.*

Smallpox makes many victims amongst the natives; the other eruptive diseases are of small account.

Bronchitis is moderately common; *Pneumonia* is rare: *Phthisis* is of frequent occurrence, rapidly terminating in death.

Hepatitis is rare; and *Abscess of the Liver* is usually a result of dysenteric lesions.

Rheumatic Fever and diseases of the heart are common.

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[1] *Archiv. de méd. nav.* 1882.

[2] *Ibid.* vol. xxvii.

Scorbutus and *purpura hæmorrhagica* are frequently met with. The spreading sore known as the Cochin China ulcer is very common among the natives, and is thought to be an outcome of the malarial infection.

Syphilis gives rise to more than one-fifth of the admissions in the hospital of Saïgon,—a fact which tells its own tale.

ANNAM AND TONKIN.

GEOGRAPHY AND CLIMATOLOGY.—Annam occupies the eastern slopes of the Indo-Chinese peninsula. The interior is hilly. The rivers running into the Gulf of Tonkin and the South China Sea are short, and little liable to overflow. The chief towns are Hué and Quin-hon.

At Hué and Quin-hon there are two seasons only: winter, from the 1st of October to the end of March; and summer, from the 1st of April to the end of September. The following are the mean temperature, C., and rainfall in mm., of Hué:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temp., .	19·0	18·9	20·7	25·4	27·5	28·7	29·2	30·8	30·0	25·3	21·4	18·7
Rainfall, . .	0·00	0·051	0·012	0·051	0·140	0·051	0·085	0·113	0·161	0·000	0·000	0·000=0·664

The coast line of Annam is generally more healthy than Cochin China, and fevers become less severe in the higher lands. The Annamites are less sickly and cachectic than the natives of Cochin China.

TONKIN, to the north of Annam, is bounded on the south-east by the Gulf of Tonkin, on the north by the Annamese province of Yun-nan, on the west by the range of mountains by which it is separated from Burma and Siam, and on the north-east by China. It forms an immense plain watered by the Song-Kai or Song-Koï, and the part occupied by the French may be said to be the delta of that river. The soil of Hai-Phong, in the delta below Hanoi, is, according to Foiret,[1] clayey and impermeable, but fertile, yielding two crops of rice a year. Maget describes the delta as a marsh, many thousand square leagues in extent,—a marsh inundated in summer and more or less dried in winter.[2] At Hanoi and Hai-Phong, the winter lasts from the 1st of November to the end of March; spring consists of April only; summer extends from May to the end of September; the month of October constitutes the autumn season. Here are the mean temperature, C., and rainfall in mm., of Hanoi and Hai-Phong:—

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[1] *Archiv. de méd. nav.* 1878.

[2] *Ibid.* 1881.

Hanoi.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temp.,	14·3	15·1	19·6	25·9	29·8	3·06	32·1	31·0	26·3	24·7	20·9	18·1
Rainfall,	0·006	0·001	0·105	0·250	0·325	0·203	0·280	0·300	0·326	0·205	0·062	0·016=2·089
Hai-Phong.												
Mean Temp.,	16·4	17·7	19·4	24·3	28·4	29·8	29·4	29·4	28·8	26·4	22·9	20·8
Rainfall,	0·008	0·012	0·035	0·054	0·197	0·208	0·379	0·396	0·164	0·076	0·060	0·018=1·507

PATHOLOGY.—Very conflicting opinions have been formed respecting the climate of Tonkin. Maget, in the article cited, says that "notwithstanding the marshy nature of the soil, malaria is less severe and certainly less diffused than in many localities in our own country" (France).

Foiret, upon the whole, supports the same view. Later experience, obtained during the war, shows that Tonkin is in a high degree malarious. Dr. Grall[1] gives it as his experience that "paludism of extreme gravity and intensity prevails in all parts beyond the delta, and that in the delta itself paludism is frequent, even in the parts considered most healthy. At Hanoi the natives are not spared. Hai-Dzuong, Phu-Ly Ninh-Binh, and all the low delta, are affected. The bay of Hong-Hai and the maritime regions are far from exempt. Quan-Yen and the peninsula of Do-Son form exceptions in a certain degree. Rey[2] gives the following figures, which bear out Dr. Grall's opinion of Tonkin.

Between the 1st August 1883 and the end of March 1885, out of 840 deaths occurring among the French troops, the causes of which were known, fevers of various kinds accounted for 294, or 35 per cent. of the total:—

Typhoid,	151
Intermittent Fever (pernicious attacks),	79
Remittent and Bilious Fevers,	42
Continued Fever,	19
Petechial Fever (purpura hæmorrhagica),	3

The months in which those deaths occurred are not given, but the monthly repartition of 356 deaths from internal diseases, which occurred in the hospitals from April 1884 to March 1885, is as follows:—

April,	22	October,	25
May,	34	November,	42
June,	64	December,	18
July,	66	January,	22
August,	20	February,	7
September,	18	March,	18

The months of June and July are those most charged with deaths. I gather from the remarks of various writers, that the months of June, July, and August are those in which malarious diseases are most common and severe. Morand, referring to Nam-

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[1] *Archiv. de méd. navale*, 1886.

[2] *Ibid.* 1887.

Dinh, says that fevers, diarrhœa, dysentery, and hepatic affections dominate the medical constitution from May till October. This may be accepted as applying to the delta generally, and corresponds to the warm and rainy season.

The different estimates formed of the climate of Tonkin are readily explained, by the fact that the earlier writers judged it by the health of troops well protected from climatic influences, not subjected to fatigue or hardship; the later writers witnessed its effect on troops exposed to the vicissitudes of weather and the fatigues of active service.

Tonkin is by no means so healthy as the first observers imagined; still, if we consider the climate and the physical character of the country, it is less malarious than might have been expected.

The extent to which malaria prevails, and the general complexion of the pathology of this region, will be understood from the following table.

Of 205 admissions to hospital at Hai-Phong, the different diseases are given by Foiret as follows:—

Anæmia,	6	Hepatitis,	6
Bronchitis,	9	Sunstroke,	14
Cholera,	2	Various Internal Affections,	11
Diarrhœa,	32	External Affections,	30
Dysentery,	15	Primary Venereal Affections,	35
Malarial Fever,	38	Secondary Venereal Affections,	7

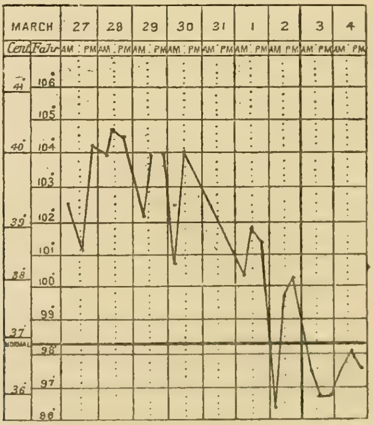
Grall says that in Tonkin, in the great majority of cases, the initial fever is sub-continued—the remissions may be wanting or may pass unobserved. In some cases the first influence of malaria may be only manifested by a general feeling of malaise, loss of appetite, sleeplessness during the latter part of the night, with short shivering or horripilation, migraine in the morning, with nausea—mostly during the heat of the day. After four or five days, fever appears with little violence; often the patient does not observe it. A temperature of 38° or 38°·5 is the maximum which is attained at mid-day. In the evening the patient feels better, but towards the middle of the night the fever recommences. In the morning there is great exhaustion, and the thermometer already shows the existence of a sub-febrile temperature. This malaise may be all "mais néanmoins l'étape est franchie," and paludism is reached. After some months, it may be, the patient will have attacks of frank intermittent. In other cases remittent fever of a severe form, with extreme adynamia, may occur. Quotidians are the most common; the tertian type is only observed in the second or third year of sojourn. Pernicious fevers are rather rare in Tonkin. In the course of the remittent form delirium or coma often makes its appearance, but in such instances the attacks are not to be regarded as pernicious, the delirium or coma being the phenomena proper to the evolution of the febrile process.

The fièvre des bois of Upper Tonkin occurs principally in uncultivated regions. Villedary describes it as a continued malarial fever of a typhoid character. The remittent fever of Upper Tonkin is bilious, marked by vomiting and diarrhœa, and proceeds by true paroxysms; only that the paroxysm of the ordinary fever lasts for a few hours only, while that of this form of remittent lasts some days —generally four or five.[1]

The following diagrams illustrative of the fever of Tonkin are prepared from the temperatures observed by Grall:—

Cases of Malarial Fever reported by Grall (*Archiv. de méd. nav.* 1886).

1. Letand, conductor in the 11th Battery of Artillery, has been twelve months in Tonkin; has had a few previous attacks of mild malarious fever; has been suffering for eight days before admission from quotidian fever of a distinctly intermittent character. On admission, extreme languor, vertigo, dyspepsia, very severe continuous headache, complete sleeplessness, the spleen was considerably enlarged, the liver much less so. From the morning after admission he exhibited a sub-typhoid condition—acute delirium at night, and wandering during the day. No abdominal symptoms. Towards the fourth day there appeared a miliary eruption very abundant and almost ecchymotic, which simulated in certain respects the mulberry eruption of typhus. On the sixth day a remission occurred, with well-marked fall in the temperature.



2. Maklouf, an Algerian, four months in Tonkin, entered hospital under the diagnosis of malarial anæmia. From the day of admission, fever ardent, skin dry; a little

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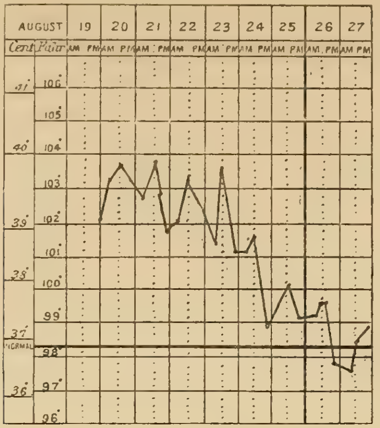
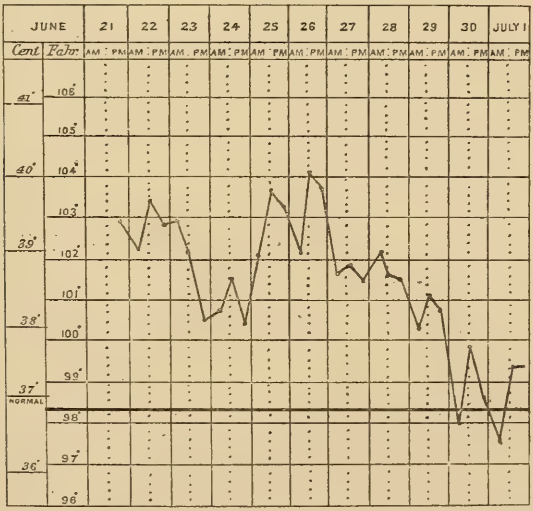
[1] Clavel states that at Chiem-Hoa, in Upper Tonkin, malaria in all its forms is extremely common: "Ses méfaits sont à peu de chose près, aussi considérable que ceux de toutes autres maladies rèunies" (*Archiv. de méd. nav.* 1890).

stupor, gastric catarrh, enlarged spleen, liver enlarged. On the evening of admission, profuse sweating. This state continued until the fourth day, when the symptoms diminished, and he entered on convalescence on the seventh day.

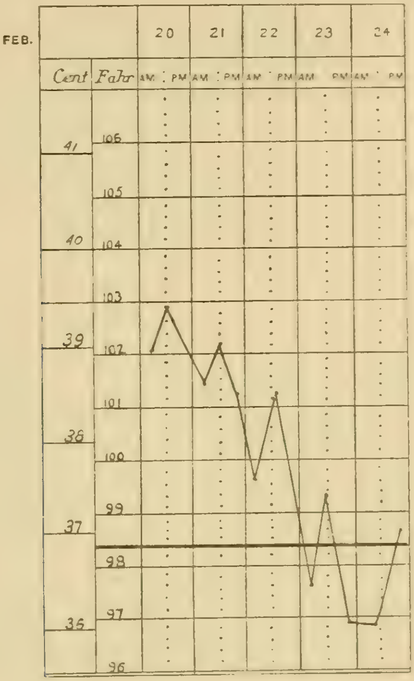


3. Vasseur, soldier, admitted to hospital on the 21st June ; has been four months in Tonkin. Since the night before admission, intense continued fever, prostration, subtyphoid condition, respiration hurried, anxiety, spleen and liver a little enlarged. No previous disease ; so that this may be regarded at the *début* of fever in this patient. Albumen in urine from the first day. Quinine was not administered until the fifth day of treatment. In the course of convalescence he had attacks of intermittent fever, and, his health being unsatisfactory, he had to be invalided home.



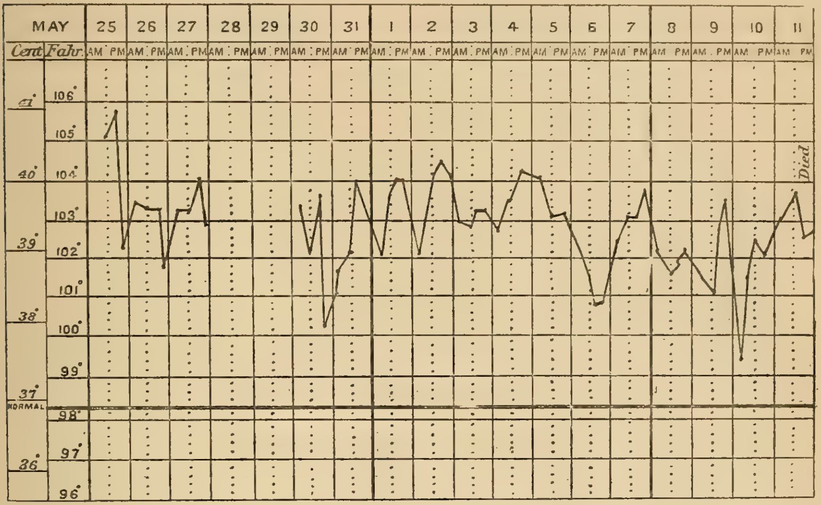
4. Lett, soldier, four months in Tonkin, has had no previous attack of fever, having arrived at the height of the cold season. Presented himself at the visit on the 20th

February, having been sick for eight days. During the last two days he has complained of continual headaches. On admission the patient was scarcely able to stand; temperature distinctly febrile, gastric catarrh, and enlarged spleen. On the evening before admission he had bilious vomiting, and this state of nausea and vertigo lasted for the first three days of treatment. There was a little prostration, some diarrhœa, and sleeplessness on the nights of the 21st and 22nd. About the 30th he was taken again with headache. This is an example of one of the mildest forms of attack.



5. Lard, a sapper in the 4th Regiment of Engineers. The disease was preceded for six days by malaise, headache, weariness, and for two days before admission by subcontinued fever with morning accessions. On admission, ardent fever, dry skin, subdelirium, slowness in replying to questions, gastric catarrh, enlarged spleen, enlargement of the liver, albuminous urine. On the fifth day the typhoid state complete with intellectual obtusion, which became more intense as the case progressed. At the end of the first week a generalised eruption of purpurous spots came out, persisting to the last; evening before death, parotitis. On making the autopsy, there was found to be very slight tumefaction of Peyer's patches; the spleen was diffluent, the liver exsanguine and fatty, kidneys very congested. That this patient was deeply affected by the malarious infection is perfectly obvious, but it is by no means so certain that the case was one of malarial fever. It rather appears to be a case of typhoid fever in a subject who had already suffered from malaria. Grall considered it to be a case of auto-typhisation in a malarious subject, and adds that similar conditions have been observed in the fièvre des bois. The fever is very irregular in its course, and does not exhibit the usual march of typhoid. It will be noticed also that the swelling of Peyer's patches is stated to have been very slight, *à peine un peu de tuméfaction*, so that considerable doubt must remain as to the nature of the case. The condition of the spleen is that observed

in the worst forms of malarial disease. It is because such cases demand further study that I quote it here. Dupont relates a case observed in French Guiana very similar to that of Lard: headache, pains in limbs, intense headache and fever, vomiting, intermittent sub-delirium; death on the fourteenth day. At the autopsy there were found congestion of lower part of small intestine and injection of Peyer's patches. The question is whether the congestion in this case or the tumefaction in Lard's case would have ended in the specific lesions of enteric fever if the patient had lived a few days longer?



Typhoid Fever causes a considerable mortality amongst the French troops, both in the delta and at many posts in the interior, notably at Bac-Ken. Out of 634 deaths from all causes, excepting accidents, suicides, and wounds, 151, or a ratio of 238 per 1000, were ascribed to typhoid fever. In Upper Tonkin the natives suffer less than the French from typhoid fever.

Cholera, according to Rey, prevails in an endemic form in Tonkin, often making great ravages amongst the natives. He notices the following years as those in which it has been more or less widely diffused:—1850, a very severe outbreak, 1864, 1865–66, 1875, 1879, 1885, 1887. Cholera is not endemic in Upper Tonkin.

Dysentery and *Chronic Diarrhœa* give rise to about a third of the total mortality among the white troops; they are also widely diffused among the native population.

Hepatitis and *Abscess of the Liver* cause about 31 per 1000 of the total deaths.

Smallpox is occasionally epidemic, and fatal among the natives, who are unprotected by vaccination. I have met with no accounts of *Scarlet Fever* in Tonkin. *Measles,* however, is not unknown.

Pleurisy and *Pneumonia* appear to be rather rare among the French troops—giving rise to a mortality of 19 per 1000 deaths from all diseases. So far as can be learned from incidental remarks, inflammation of the lungs occupies a more prominent place in the pathology of the natives.

Phthisis is far from rare among the natives. Among the troops the deaths from tubercular diseases number 31 per 1000 of the total mortality, excluding accidents, suicides, and wounds.

Anæmia, resulting from malaria, is widely diffused among the native population, and *Scrofula* is also very common.

Leprosy is very prevalent in Tonkin. In the neighbourhood of Hanoi and Sontai there are villages inhabited by lepers only. It is more common in the delta than in the mountainous districts of the interior.

Beriberi, in sporadic cases, and in localised outbreaks, is met with.

Syphilis is more frequent in the delta at the present day than in former years. Clavel states that the disease is entirely unknown at Chiem-Hoa, in Upper Tonkin, as the Muong women do not abandon themselves to prostitution.

CHAPTER III.

CHINA.

GEOGRAPHY.—China, exclusive of its dependencies, such as Manchooria, Mongolia, and Tibet, extends between 18° and 49° N. lat., and 98° and 124° E. long. Its area has been estimated at 1,297,300 square miles, with a population of about 380 millions. It is divided into nineteen provinces, including the island of Formosa, which has been recently separated from Fû-chien. The country has a general slope from the mountainous regions of Tibet and Burma on the north and west towards the shores of the Pacific on the east and south.

The Nan-ling range of mountains, an offshoot from the Himalayas, traverses the south of China from Yun-nan on the west to Ning-po on the east, forming the northern boundary of the provinces of Kwang-hsî, Kwang-tung, and Fû-chien. This range forms an unbroken barrier between south-eastern China and the northern part of the country. Another chain connected on the west with this range takes a more northerly direction, and, after separating the interior provinces of Hû-nan and Chiang-hsî, is continued through An-hui to terminate west of Shanghai. The whole country to the south of these ranges is hilly in the east and mountainous in the west. The country to the north of these ranges may be divided into two regions. The first, situated west of the 113th meridian on to the borders of Tibet, is hilly; that to the east constitutes the great plain comprising the provinces of Chih-lî, Shan-tung, Ho-nan, An-hui, and Chaing-sû. This plain extends for 700 miles from the Great Wall and Barrier Range north of Pekin to the Poyang Lake in lat. 30°. Its western boundary extends from King-châu in Hupei, through Hwai-king, on the Yellow River, in a straight line to the Great Wall, 50 miles west of Pekin.[1]

The two great rivers are the Hoang-ho or Yellow River in the north, and the Yang-tse-Kiang in the centre. Both of these rise in Tibet; the former, after a course of 2600 miles through the northern provinces, with a basin area of 537,000 square miles, falls into the sea at the Gulf of Pe-chi-li; the latter, after pursuing a tortuous course of 3300 miles through the central provinces, with a basin area of 548,000 square miles, reaches the Pacific to the north of Shanghai. To the south of the Nan-ling range runs another river of large size, named the Choo-Kiang, which rises in Yun-nan, traverses the provinces of Kwang-hsî and Kwang-tung, and falls into the sea near Canton. These rivers, and others of less importance which we cannot enumerate, often give rise to extensive and destructive inundations of the alluvial plains through which they flow. The Grand Canal, in the north-east, having a length of 650 miles, connects Tien-tsin with Hang-châu.

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[1] Williams, *The Middle Kingdom*, New York 1883.

Many lakes, some of them of considerable size, are found in every part of the country. The Tung-ting Hû, in the north of the province of Hû-nan, has a circumference of 220 miles; the Poyang Lake, in the province of Chiang-hsî, is also of considerable size, and both are connected with the Yang-tse-Kiang river.

Many of the provinces abound in marshes, especially those along the Grand Canal, and in the vicinity of rivers which are liable to overflow. The region round Nanking is described as a half-drained plain of vast extent.

Climatology.—Many diversities of climate must be looked for in a country stretching from the confines of the tropics to comparatively high latitudes, and attaining, in the interior, to high altitudes.

Unfortunately the climatology of the interior is little known.

Baber[1] remarks that "on the Tibetan border, but still on the great plateau, *i.e.* in the region of which Batang may be considered as the centre, the rainy season is almost perfectly regular, extending from the beginning of June to the middle of August; the rest of the year is fine."

The following is the mean temperature at Ch'ung-Ch'ing, 29° 34′ N. and 106° 50′ E., about 845 feet above the sea-level:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
44·5	48·5	54·6	64·9	70·1	75·4	80·7	82·6	76·9	65·3	57·7	49·8	61·2

At Ichang, in lat. 30° 14′ N. and 111° 18′ E., the temperature from April to September was as follows:—

	Apr.	May.	June.	July.	Aug.	Sept.
Maximum Temperature, ...	82·0	89·0	88·0	95·0	97·0	87·0
Minimum Temperature, . . .	43·0	57·0	67·0	70·0	69·0	[illegible]
Rainfall, ...	5·38	9·32	8·96	6·85	3·07	[illegible]

The range of temperature is here very considerable, and the rainfall heavy.

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[1] Baber, *Supplementary Papers, R.G.S.*, vol. i., Lond. 1886.

At Tien-tsin, in latitude 39° 9′, the temperature (maximum and minimum) is as follows:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum, . . .	38·0	46·0	68·0	87·0	94·0	107·0	108·0	100·0	92·0	77·0	42·0	50·0
Minimum, . . .	0·8	1·5	18·0	35·0	41·0	53·0	61·0	60·5	40·0	40·0	17·5	3·0

Here, again, we are struck with the high range between the maximum and minimum temperature throughout the year.

The temperature at Pekin is almost the same as that of Tien-tsin, the extremes ranging from 104° to 0° F.

The following table gives the mean annual temperature of the summer and of the winter seasons at four stations situated along the coast from north to south:—

Place.	Latitude.	Summer Temperature.	Winter Temperature.	Year.
Cheefoo, ...	37° 35′	85·0	36·0	60·0
Shanghai, ...	31° 15′	81·0	40·0	58·0
Foochow, ...	26° 2′	83·0	48·5	64·0
Macao, ...	21° 1′	85·0	52·0	70·0

In the north the winters are severe, and the summers excessively hot; as we proceed southwards, the mean summer temperature does not increase; the winters, however, become much milder, and the mean annual temperature higher. Canton, according to Williams, is the coldest place on the globe in its latitude, and the only place within the tropics where snow falls near the seashore. The average rainfall on the north coast varies from 30 to 35 inches, the maximum fall occurring, as a rule, in summer. At Pekin the rainfall is scanty—seldom reaching 26 inches a year, most of it coming in July and August. At Foochow the rainfall is, on an average, about 40 inches, spring and summer being the wet seasons; at Shanghai it is 36 inches. At Macao, in the south, the fall is heavier, the average being from 60 to 70 inches; the period when the rains are most abundant being from May to October. At Canton most of the rain falls in May and June; the average rainfall in sixteen years was 70 inches.

PATHOLOGY.—It is to the valuable reports of the medical officers of the Imperial Customs' service that we are chiefly indebted for what is known of the diseases of China; but these unfortunately refer only to the Customs' ports.[1] The reports of medical missionaries also furnish useful information respecting the diseases of the natives in several of the larger towns along the coast and in the capital; but very little is yet known respecting the diseases prevalent in the interior.

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[1] Gordon's *Epitomé of the Reports of the Medical Officers of the Imperial Customs' Service*, Lond. 1884.

Malaria.—The experience derived from the medical history of the troops indicates that the northern are less malarious than the southern coast provinces. The following table gives the admissions and deaths per 1000 among the troops stationed in North and South China from 1859–62:—

North China.		South China.	
Paroxysmal Fevers.		Paroxysmal Fevers.	
Admissions.	Deaths.	Admissions.	Deaths.
231·3	3·49	571·2	9·26

We shall proceed to give a short account of some of the localities, respecting which reports have been published, beginning with those situated in the interior; then those along the coast line from north to south; and, lastly, we shall notice some of the islands near the coast.

The valley of the Upper Salween in Western Yun-nan is reputed to be extremely malarious. Grosvenor was warned to cross it in all haste. He tells us that this valley is "uninhabitable during the summer months on account of the malaria, the natives retiring as soon as the fields are planted, and returning to reap them in August."[1] Williams informs us that the natives consider Kwang-tung, Kwang-hsî, and Yun-nan to be the most unhealthy of the eighteen provinces, and use them as places of banishment for criminals.

ICHANG, in 30° 14′ N. lat. and 111° 18′ E. long., is situated on the north bank of the Yang-tse-Kiang near the mountains. The climate here is more extreme than that of the coast, and, as we have seen, the temperature range is high. The country in the neighbourhood of the town is subject to inundations.

This station furnishes quite a number of cases of ague.

HANKOW is situated in 30° 30′ N. lat. and 114° E. long., at the junction of the Han with the Yang-tse-Kiang. Since the opening of this port in 1861, the town has been three times submerged, viz. in 1866, 1869, and 1870. After each of these occasions, fever and cachexia occurred. Fevers, which affect alike the natives and foreigners, prevail annually in September and October; and when they follow inundations, they appear during the same months. In the half-year ending September 1875, fever, more particularly of a continued type, prevailed. It rarely set in with rigors; it was accompanied with nervous prostration, lasted for two or three weeks, and ended with profuse perspirations. Quinine, in doses of 20 to 30 grains, night and morning, exercised a good effect on its course.

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[1] *Supplementary Papers, R.G.S.*, vol. i. p. 177.

At KIUKIANG an epidemic of malarial fever, of the most malignant character, occurred in the autumn of 1872 among the natives in the district of Lin-kiang and Suy-chou, south of the Poyang Lake. Here we find all the usual types represented, and, in addition, cases of intermittent diarrhœa appear to have been observed.

During the autumn of 1880, malarial fever, remittent and intermittent, was again common; the persons who suffered most were those that were in the habit of bathing in the lakes in the evenings. At a village 30 miles east of Kiukiang, a severe form of remittent fever prevailed in 1882, characterised by great anæmia, enlargement of the spleen, and, in about one-third of the cases, there was ulceration of the cornea. Cancrum oris was also a sequel of this fever.

PEKIN is situated on an alluvial, sandy, but well-cultivated plain, 13 miles north-west of the Pei-ho river. No marshes exist in the neighbourhood. The water-supply is excellent. Filthy pits, which take the place of drains, and are full of water in the rainy season, are numerous in the city. The annual rainfall averages about 26 inches. The town and its vicinity are by no means exempt from fever. In 1873 ague prevailed to such an extent as to constitute an epidemic.

TIEN-TSIN is situated on the right bank of the Pei-ho, 35 miles from the sea. The British troops in the late war were encamped outside the walls of the town. Muir describes the plain, as he saw it in September, as being dry; but from the fact that the villages were placed on elevated artificial mounds, he inferred that it was subject to inundation. The soil is comprised of sand and light clay. The ground on which the camp was placed was covered with the salt gelatinous grass (samphire), such as grows in England on parts occasionally covered by the sea. The land around the camp was cultivated by means of irrigation. Most of the drinking water used by the troops was obtained from clean blocks of ice.

During the time the troops were encamped at Tien-tsin, several cases of fever of a continued type occurred, with serious cerebral complications; but diarrhœa and dysentery were by far the most fatal maladies.

Remittent and intermittent fevers are not uncommon among the native population; the former is said to have appeared in Tien-tsin for the first time after the inundation of 1871; the type of the fever is tertian and sometimes quotidian. In the early part of 1879, fevers prevailed, but they ceased, we are told, on the occurrence of heavy autumnal rains. This was supposed to be accounted for by the circumstance that the marshy grave-dotted grounds at the back of the settlement became inundated, and the large pits filled with water. We judge that malaria is moderately prevalent in this district.

At Cheefoo, in 37° 35′ N. lat. and 121° 22′ E. long., fevers are rare, but they are more common in the south-west of the province, which is saturated with rain during the summer season.

Chin-kiang, in 32° 12′ N. lat. and 119° 26′ E. long., on the south bank of the Yang-tse-Kiang, and Wu-hu, in 31° 19′ N. lat. and 118° 23′ E. long., appear to be only slightly malarious.

Nanking, surrounded with marshy land, proves unhealthy to the natives from other provinces, as well as to Europeans. "Every one who comes here must prepare himself for tertians or quotidians."[1] The lower stretches of the Yang-tse-Kiang are malarious during October and November.[2]

Shanghai, in 31° N. lat., is situated on a flat, treeless alluvial plain, on the left bank of the Woosung river, at the mouth of the Yang-tse-Kiang. For miles inland the country does not rise more than a few feet above the level of the river. The soil is a rich loam, well cultivated. Intermittent and remittent fevers are endemic. In 1870, out of 490 cases treated in the general hospital, 53 were cases of intermittent fever and 10 of remittent, of which 2 died. Enlargement of the spleen, congestion, and inflammation of the liver, diarrhœa, and dysentery, are all common in this city and its neighbourhood.

Dr. Henderson described in 1861 a form of fever as not uncommon in Shanghai, beginning with rigors, followed by the hot and sweating stages. "The cold stage," he says, "is often severe, and acute delirium sometimes appears in the hot stage. If the disease is neglected, the tongue becomes coated with a brown-dry fur, the liver becomes deranged, there are bilious vomiting and diarrhœa, with tenderness and pains in the right hypochondrum; rheumatic symptoms occur, purpurous spots appear, blood is discharged by the mucous membranes, great prostration ensues, and the patient dies comatose or delirious. Quinine often disagreed in this form of fever.

Ningpo, in 29° 55′ N. lat., on an alluvial plain, intersected by streams and canals, is malarious. Fever of the tertian type is said to be very common.

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[1] Williams, *Op. cit.*

[2] *Stat. Report Health of Navy*, 1887.

WENCHOW, in 28° 1′ N. lat. and 120° 38′ long., on the south bank of the Ou-kiang, built on a reclaimed marsh, reticulated by canals, and almost on a level with their sluggish waters, is the abode of intermittent fever; but the attacks are of no great intensity, excepting in the case of new-comers.

FOOCHOW is described as lying high, the soil consisting of red clay and disintegrated granite, and the natural drainage perfect. Fever is not entirely absent, but it is comparatively mild.

At AMOY, in 24° 10′ N. lat., malaria is common and intense. Fever forms about one-sixth of the total cases treated; enlargement of the spleen is said to be common in persons living in malarious districts, sometimes without any history of ague. Ulceration of the leg is a frequent accompaniment of malarial anæmia, and it is observed that the subjects of malarial anæmia are liable to hæmorrhages from the nose, kidneys, and rectum. SWATOW, to the south of Amoy, suffers perhaps somewhat less from endemic diseases.

CANTON is one of the most southerly parts of China. Here malarious diseases are endemic in the city and its neighbourhood, and also at all the anchorages down to Hongkong. In 1841, many deaths from fever occurred among the marines that landed to assault Canton; those who remained on board suffered less, but did not escape entirely. A peculiar form of remittent fever was observed at Canton in August and September 1879, affecting both the Chinese and foreigners. The attack began with nausea and headache, without chills, and with a temperature only slightly above the normal. After twenty-four hours, the body became suffused with a slight flush, and very profuse perspirations followed, recurring at intervals of four hours, but unattended by flush, nausea, or headache. Quinine, in large or small doses, had no effect.

FORMOSA.—Fever is met with at Tamsui and Keelung in the north, and at Takow and Taiwan-fu on the south-west. The whole coast line is probably malarious; about the interior little is known. The French soldiers operating in Formosa, during the late war, suffered very severely from fever, more so, indeed, than the troops in other parts of China.[1] It is stated that of 100 soldiers received sick on board the *Chateau-Yquem*, 80 were suffering from intermittent fever. Dr. Meyer, in his report on the health of Takow and Taiwan-fu for 1886, has described a fever as prevailing in Taiwan-fu which exhibits more of the symptoms of typhoid than those of malarial fever, including the rose spots and pea-soup stools; but differing remarkably in this particular, that, although very obstinate, it is rarely, if ever, fatal. He also describes a malarious form of tabes-dorsilis, curable by quinine and cod-liver oil, and notices the frequency of chronic albuminuria as a symptom of malarial infection, and which is often improved or cured by means of quinine.

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[1] *Archiv. de méd. navale*, 1886.

The PESCADORE ISLANDS, between Formosa and the mainland, were occupied by the French during the late war. Petit (*Arch. de méd. navale*, 1886) says that they are 25 to 30 mètres above the sea-level, contain no marshes, no rice fields, and no luxuriant vegetation, but that the troops stationed there, nevertheless, suffered severely from malaria.

HÂI-NAN, a large island lying between the Gulf of Tonkin and the China Sea, forms part of the province of Kwang-tung. Sollaud states that the prevailing diseases at Hoi-hau, the principal sea-port, were affections of the digestive tube and its annexes—catarrhal diarrhœa, dysentery, congestion of the liver, and abscess of that organ as a sequel of dysentery. Malarial fever is not more common at Hoi-hau than at other Chinese ports. The forms met with are the quotidian, rapidly inducing cachexia, the tertian, sometimes bilious or gastric remittents, and occasionally even pernicious forms.

Smallpox, phagedenic ulcers of the lower extremities, and skin diseases are also common.

Having traced the distribution of malarial diseases so far as our present knowledge of the country renders possible, we shall briefly notice some of the other diseases which are met with in this vast empire.

Typhoid Fever.—This disease is prevalent at Pekin, where it may be said to be endemic. At Shanghai, according to Jamieson, "it is constantly lying in wait for the unwary." At Foochow, typhoid fever is reported to be endemic, and it is far from rare at Ningpo. Swatow, Amoy, and Chin-kiang, on the other hand, are comparatively free from the disease. In the interior, typhoid fever is stated to be rare at Hankow and Kiukiang; nor does it seem to have been observed at Ichang, on the middle stretches of the Yang-tse-kiang river. As our knowledge of the diseases of the native population increases, it will probably be found that enteric fever is much more widely diffused than is at present suspected. A form of fever, described as typho-malarial, is, as already stated, frequently seen at Tai-wan in Formosa. It is evidently a modified form of enteric fever of a remarkably mild type. This form of fever is not observed at Takow.[1]

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[1] A form of fever has been observed in Canton, which is marked by remissions during the first three or four days, then taking on a typhoid type, with great oppression, frequent pulse, delirium, and epistaxis. This is probably a modified form of typhoid.

Typhus has been noticed in Pekin, Tien-tsin, Cheefoo, and Foochow, and at Kiukiang in the interior. At Shanghai, we are told, the disease is rare; and at Amoy it is remarked that, although the town is full of typical fever dens, typhus is not met with. At Canton, a fever known as *chut-pan*, or spotted fever, prevailed in 1879, which was probably typhus.

Relapsing Fever.—The only notice I have observed of this disease refers to Tien-tsin and Pekin, although, according to Morache, it was epidemic in other parts of Northern China in 1864–65, when it was raging in Pekin along with typhus. In 1877, relapsing fever was prevalent along with typhus and typhoid at Tien-tsin.

Dysentery and Diarrhœa are amongst the most widely diffused and fatal maladies met with in China. Dysentery is of frequent occurrence, and of a severe and intractable type, at Ichang and at Hankow in the interior. At Hankow, dysenteric and diarrhœal affections formed, according to Lombard, 6 per cent. of the diseases treated at the mission dispensaries. At Pekin these diseases are reported to be prevalent. Dysentery and diarrhœa were, as we have already said, the most common and fatal complaints from which the British troops suffered at Tien-tsin. At Shanghai these diseases form 6·7 per cent. of the cases treated at the mission dispensaries. At Foochow they form more than one-third of the diseases of the European residents. Diarrhœa is common at Amoy, but dysentery is of less frequent occurrence. In short, in every region of China with which we are medically acquainted, we find diarrhœa and dysentery occupying the first rank amongst the diseases of natives and Europeans.

So far from the colder regions of the north enjoying any immunity from these affections, they appear to be even more frequent and fatal in the north, with its high summer temperature, than in the south. The following were the admission and death rates from dysentery and diarrhœa amongst the troops in the north and south of China from 1859 to 1862:—

North China.		South China.	
Admissions.	Deaths.	Admissions.	Deaths.
340·3	24·9	211·0	11·75

Cholera made its first inroad into China in 1820, through which, as Hirsch relates, it spread devastation from one end to the other during the two following years. Its next appearance was in 1830, then in 1857–60, when it caused a great mortality. It was again epidemic in 1863–64, and its last great outbreak was in 1877.

Diphtheria prevails in the northern provinces, where it has repeatedly appeared in destructive epidemics. In the winter of 1865–66 the deaths from diphtheria in Pekin were estimated at 25,000. In 1877 the disease broke out among the children of the Eurasian school at Shanghai; but it does not appear to be common, even if it is at all known among the natives in this part of the country. We frequently meet with accounts of epidemics of so-called *Quinsy* in various parts of China, and as they appear to be of a fatal nature, the question suggests itself whether some of these do not really refer to outbreaks of diphtheria? At Niu-chwang, in 1880–81, quinsy attacked nearly every foreign adult in the settlement. The majority of the patients had more than one attack, and, in some instances, the disease was very severe. The largest number of cases occurred in the first half of winter, and after a considerable fall of snow the cases diminished in number and severity.

Dengue was observed in some parts of China in 1872, but it does not appear to be a frequent visitor.

Influenza has been frequently epidemic since the country has been known to Europeans, and some have even supposed that the great inundations, from which China so frequently suffers, have something to do with the generation of the miasm which gives rise to the pandemic extensions of the disease that are witnessed from time to time.

Plague is endemic in the mountain valleys of Yun-nan. In 1871 and succeeding years it became widely diffused over a large area, causing fearful havoc among the population.[1]

Smallpox was known in China, according to some scholars, so far back as 241 B.C.; but, according to others, it was first observed during the reign of Chien Wu, about A.D. 317. It is frequently and severely epidemic in all parts of the empire; but the whole country is not affected at the same time. The epidemy is limited to one or more provinces in a given year, showing little tendency to spread to contiguous districts, in which it will suddenly appear when there is none of the disease about. This, as we have pointed out, is a peculiarity of its epidemic manifestations in India. The disease is no doubt largely propagated by the practice of inoculation, which is effected by placing a pledget containing the virus in the nostrils (Williams).

Measles appears to be endemic in China, assuming at certain times an epidemic form over large areas, and causing a heavy mortality. At Shanghai, a modified form of the disease, or perhaps a distinct disease, called "wind-measles," affected many persons in

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[1] Grosvenor, *Supplementary Papers, R.G.S.*, vol. i. p. 178.

September and October 1871. It is marked by a short period of incubation, and by the absence of catarrh. The eruption appears on the third day all over the body, with intense tingling, but is not disposed in the crescentic patches characteristic of ordinary measles, and ends in a furfuraceous desquamation. Shining vesicles appear in the throat before the rash comes out. A previous attack of measles does not insure immunity from the disease.[1]

Scarlet Fever is occasionally seen in Europeans residing in China; but, if known at all, it is certainly rare among the natives. According to Jamieson, it is very rare in Shanghai. Dr. M'Kenzie was assured by missionaries that scarlet fever was epidemic at Ningpo in 1874, but I have met with no other statement to a like effect. I think it extremely doubtful if scarlet fever is really endemic in the country.

Phthisis is stated to be rare in Shanghai; to be less common in Canton than in Europe and America; to be prevalent in Pekin, where it is supposed to be contagious; and to be met with in various degrees of frequency in every part of the empire hitherto visited by Europeans.

Bronchitis and *Pneumonia* are of frequent occurrence throughout the north of China; the only locality in this region in which these diseases are stated to be rather rare is Cheefoo. To the south, at Ningpo and Foochow, chest affections are common, but not severe. In other words, bronchitis is more common than pneumonia in the south-eastern provinces of China. Everywhere they appear to be most frequent in spring.

Hepatitis is moderately common in the southern provinces. At Shanghai and its neighbourhood foreigners are reported to suffer considerably from this disease. Epidemic *Jaundice* is stated to occur each spring and autumn at Pekin.

Abscess of the Liver is rare in Shanghai, Foochow, Hankow, and at Takao and Tai-wan in Formosa. Altogether, I gather from the reports that liver abscess is by no means a common disease in China.

Syphilis is reported to be common among all classes in Pekin, Kiukiang, Foochow, and is virulent and rife throughout the country generally, and also among the aborigines of Formosa.

Leprosy prevails to a greater or lesser extent all along the coast line, especially in the provinces of Cheh-Chiang, Fû-Chien, and Kwang-Tung (Canton). In the last, leprosy is widely diffused. Dr. Manson reports it to be very prevalent in the villages near Amoy, in which he estimates the lepers to be in the proportion of

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[1] See article on Chinese Measles, *Archiv. de méd. nav.*, vol. xliv.

1 to 450 of the population, and it is of somewhat frequent occurrence at some points, such as Hankow in the interior; at Kiukiang it would appear to be rare, as only three cases of the disease were observed among 1420 patients under treatment. It is not absent from the coast towns of the north, as we find 10 or 12 cases were treated in 1872 at Cheefoo. At Tai-wan, in Formosa, it is stated "not to be common."

Elephantiasis is somewhat frequent along the coast line between Shanghai and Canton.

Scrofula is reported to be excessively common in the coast towns, but to what extent it prevails in the interior is unknown.

Beriberi has been endemic in China for ages, and occurs both in the wet and dry forms; but at the present day it is comparatively rare.

Goitre is endemic in North China, both on the plains and in the mountainous districts. In the villages on the high lands between Pekin and Je-ho it is estimated that a sixth of the inhabitants are goitrous. It is also widely prevalent in Western Sze-Chwan and Yun-nan on the borders of Tibet. At Kung-mu-ying the natives ascribe the disease to the qualities of the Yen-yuan salt. The salt of Tzu-lin-ching, by their account, has no such effect. They believe that sea-weed, certain kinds of which enter largely into Chinese cookery, is a specific for the swelling. In some villages more than half the women are affected. The floor of the valleys where the disease is met with is mostly sandstone, but the ridges on the east are of limestone, and the brooks have run a long way through this rock. In the district of Yu-Yang, in Eastern Sze-Chwan, on the other hand, which is a limestone country, goitre is unknown. "It is observable that it is not prevalent in the topmost regions of a country, but occurs in valleys or hollows, though whether the situation be a confined ravine or a slightly depressed and open amphitheatre is indifferent." These ravines seem to be well ventilated by high winds. Baber suggests that the water of goitrous villages may not merely have to pass through limestone, but must have to run for a considerable distance through that rock before acquiring noxious properties.[1]

Tibet.—So meagre is our knowledge of the diseases of Tibet, that it is needless to enter into any particulars respecting the climatology of this elevated table-land. Huc informs us that the Tibetan physicians enumerate no fewer than 4440 distinct maladies. Notwithstanding the richness of their nosology, a few lines will suffice to mention those diseases which I have found mentioned in the works of travellers which I have consulted.

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[1] Baber, "Travels and Researches in the Interior of China," *Supplementary Papers, Roy. Geog. Soc.*, London 1886.

Intermittent Fever is certainly not unknown in Tibet, but in what districts the cases to which incidental allusion is made chiefly occur is unknown.

Smallpox, which is very prevalent, is the malady of which the natives stand most in dread.

Rheumatism is very common amongst the population of Lhassa, and, from what we can learn, it is a prevalent affection in all parts of the country.

Leprosy and *Itch* are prevalent. *Hydrophobia* is common, and *Ophthalmia* and *Goitre* may be looked upon as endemic.

In addition to this list of prevalent diseases, Lombard enumerates, on the authority of a missionary who had lived for several years in Tibet, cholera, dysentery, colic, bilious vomiting, cystitis, and venereal diseases as maladies of frequent occurrence.

I have met with nothing to enable me to form any opinion as to the prevalence of *Pneumonia*, *Bronchitis*, or *Phthisis* in this region.

CHAPTER IV.

HONG-KONG.

GEOGRAPHY.—The island of Hong-Kong was ceded to England in 1841. It is separated from the mainland of China by the Ly-ce-moon strait. The peninsula of Kowloon, which lies opposite to Hong-Kong, and separated from it by the strait, which is here about a mile broad, was ceded to England in 1861, and forms a part of the colony. The extreme length of Hong-Kong is 11 miles, and its breadth from 2 to 8 miles. Its coasts, especially on the south, are deeply indented with bays. The island is mountainous, the capital, Victoria, being dominated by a peak 1774 feet high. Another peak, Mount Gough, attains an elevation of 1880 feet. Between the mountains lie valleys which are under rice cultivation. The soil is a reddish-yellow clay, formed of disintegrated granite, very retentive of moisture, but not naturally containing much organic matter.

Victoria, from its situation on the north-west shore, and from the high range by which it is backed, is sheltered from the influence of the south-west winds, which blow from May to October. The settlements of Stanley and Aberdeen, on the south coast, are freely exposed to these winds.

The Chinese in 1886 numbered 173,100, and the civilian European population 6200, giving a total of 179,300.

CLIMATOLOGY.—The mean annual temperature is 75° F. The summer is hot and rainy. The monthly temperature and rainfall for 1886 will be given in connection with the seasonal prevalence of fever.

VITAL STATISTICS.—The average death-rate of the Europeans in 1885–86 was 28·0 per 1000; that of the Chinese community, 28·9 per 1000. The quarterly death-rate amongst the Chinese for 1885–86 was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
21·80	27·60	36·92	30·80

The warm months, June, July, and August, are the most unhealthy, not only amongst the Chinese, but also amongst the Europeans. The months of December, January, and February are the healthiest.

PATHOLOGY.—*Malaria.*—For years after its occupation Hong-Kong proved excessively unhealthy, the troops and civilians alike suffering from the severer forms of malarial fever, which often proved fatal. At the present day a great decrease in the fever death-rate has taken place, although the general death-rate is still high.

The cause of the fever, which proved so fatal during the early years of the colony, has given rise to much discussion. Friedel, quoted by Parkes,[1] considered that "the soil of the woods and dells, and of the clefts in the rocks, which is derived from the granite, and is soon filled with cryptogamic vegetation," was the source of the malaria. Smart[2] ascribed the fever to the drying up of the rice fields in October, November, and December. Some, again, have blamed the position of the capital, which shuts it out from the influence of the south-west monsoon; others have ascribed the fever to general climatic conditions; whilst many, with greater reason, have considered the upturning of the soil on a large scale, during the early years of occupation, when so many new buildings had to be constructed, as the chief cause of the epidemic fever which caused such havoc from 1841 to 1846.

That the position of Victoria played any important part in determining its unhealthiness, is negatived by the great improvement which has taken place in late years, and also by the circumstance that the stations of Stanley and Aberdeen, on the south coast, were as malarious as Victoria. Whether the emanations from the rice fields could reach Victoria is at least doubtful; but if so, the question arises why they are now comparatively innocuous? The disturbance of the soil at all the stations during the first years of occupation, when public buildings had to be erected, when the means of carrying off the heavy rainfall were insufficient, and when sanitation had not even been begun, must be regarded as the most probable cause of the alarming mortality among the troops after its occupation. This view receives support from two facts. 1. The disturbance of the soil is, up to the present time, followed by outbreaks of fever. In the Colonial Surgeon's report for 1885, we read that "Whitefield police station sends on the worst types of malarial fever cases." This is said to be "entirely due to the great amount of earth-cutting in virgin soil going on in the neighbourhood." 2. From the experience of the 99th Regiment in the peninsula of Kowloon shortly after its cession. Diggings were being made for the erection of new barracks; the greater part of the soldiers encamped near these cuttings were seized with fever, while their comrades remaining at Victoria, little more than a mile distant, enjoyed good health. It was remarked, too, that fever was more prevalent among those who were quartered nearest the cuttings than amongst those living at a greater distance. In our review of malarious diseases in different parts of the globe, we have had abundant evidence of the danger of earth-cuttings in malarious countries. Were this danger more thoroughly understood and appreciated, much loss of life might be saved.

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[1] Parkes, *Hygiene*, p. 343, London 1878.

[2] *Trans. Epidem. Soc.* vol. i. p. 191.

The only record I have come across of the monthly admissions and deaths among the troops from fevers during this early period, is that of a detachment of the 18th Regiment, stationed at Stanley from the first of April 1845 to the 31st March 1846, which I here reproduce:—

1845.	Admitted. Per 1000.	Died. Per 1000.
April,	232·5	0·00
May,	90·2	2·43
June,	199·4	2·93
July,	260·8	9·31
August,	577·0	19·63
September,	458·0	17·48
October,	386·3	26·00
November,	197·0	61·29
December,	136·3	27·72
1846.		
January,	20·0	20·00
February,	23·7	6·75
March,	7·0	0·00
Total,	2588·2	193·54

From the returns of the Naval Hospital I gather that continued fevers attain their maximum in July and August. Remittent fever prevails in July, August, and September, to attain its maximum in October. The month of August was that during which fever was most prevalent, and the month of November that in which it was most fatal, during the epidemic period. It will be seen from the following table that it is still most fatal in the months of October and November:—

MONTHLY MEAN TEMPERATURE, RAINFALL, AND DEATHS FROM FEVER, 1886.

Months.	Mean. Temperature.	Rainfall.	Number of Fever Deaths.
January,	60	2·02	62
February,	54	1·54	66
March,	62	2·60	93
April,	69	5·68	75
May,	76	1·78	82
June,	80	10·63	116
July,	81	28·24	109
August,	81	9·08	117
September,	80	3·00	137
October,	77	2·82	144
November,	69	0·05	143
December,	60	2·25	85

The fever in 1845 and 1846, which proved so fatal, was of the intermittent, remittent, or continued form. The following is a statement of the comparative fatality of the different types at that period:—

In 2038 cases of Intermittent Fever, 18, or 8·83 per 1000, proved fatal.
473 ,, Remittent ,, 79, or 167·02 ,,
212 ,, Continued ,, 8, or 37·76 ,,

The remittent form was, at that time, often accompanied with delirium and coma. In some cases of the intermittent type dangerous collapse appeared at the commencement. Cold sweats, vomiting, rigors, severe diarrhœa, sometimes with cramps, but without suppression of urine, characterised the cold stage; the hot stage was marked by severe fever, lasting for two or three days, and ending by sweating. The remission was of variable duration, but was often followed by a fatal exacerbation.

To show how entirely different is the character of the remittent fever met with at Hong-Kong at the present day, we may mention that in 1886 there were 1623 admissions into the General Hospital; of these 310 were suffering from remittent fever, and one died. During the same year there were nine admissions for intermittent fever, without a death. The total fever death-rate, however, of the Colony in that year was in the proportion of 6826 per million, or 6·82 per 1000 living. In the same year the death-rates from the various forms of fever amongst the European community, numbering 6200, were as follows:—

	Ratio per 1000.
Simple Continued Fever,	1·30
Remittent and Malarial Fevers,	2·42
Intermittent Fever,	0·16
Typhoid Fever,	0·32
Typho-Malarial,	0·16

This gives a total fever death-rate of 4·36 per 1000. This is undoubtedly a high mortality, but the fatality of the malarial element has greatly diminished of late years, as will be seen by referring to the mortality among the troops in 1845–46.

Typhoid Fever.—The deaths registered as due to enteric fever among the Chinese population for the seven years 1880–86 averaged 276. The numbers vary in an inexplicable way from year to year. Thus, in 1882 there were 679 deaths, while in 1886 the number was only 9. The average death-rate from enteric fever, estimating the mean population of the Colony during that period at 165,000, was 1·67 per 1000.

Typhoid fever does not appear to be so common among the Chinese as among the Europeans. Out of 590 admissions of Europeans into the Civil Hospital in 1886, there were 8 cases of enteric fever; while 340 admissions of Chinese furnished only 1 case of typhoid.

Typhus Fever is not unknown; the average annual number of deaths ascribed to typhus from 1880 to 1886 was 7·6.

Diphtheria does not appear among the diseases treated in hospital in 1885 or 1886; but as 523 deaths, out of a total of 5100, occurring in 1886, are ascribed to quinsy, we may rest assured that throat affections of a much more dangerous nature than what we know as quinsy are frequent in the Colony.

Dysentery and Diarrhœa are among the most fatal maladies in Hong-Kong. In 1886 dysentery is stated to have caused a death-rate of 697, and diarrhœa of 1846 per million. The European community is particularly liable to dysentery, while diarrhœa is very fatal among the natives. The deaths from bowel complaints show two periods of maximum prevalence, the first in July, when the temperature is at its highest, and the second in November, when the temperature is falling, but when malaria is rife.

That peculiarly obstinate form of diarrhœa, called "*Sprue*," is of somewhat frequent occurrence in Hong-Kong. The motions are frothy and light-coloured, and are generally restricted to the morning hours; the constitution rapidly suffers, the patient becoming weak and anæmic. This form of diarrhœa is best treated by change of climate.

Chest Affections are also somewhat fatal in the Colony. In 1886 these complaints occasioned a death-rate of 2438 per million. We have no means of discovering the relative prevalence of the individual diseases comprised in this group. Chest affections are most fatal from September to February, the months of October and November being those most charged with deaths from these complaints. Their minimum fatality occurs in August.

Phthisis.—The deaths ascribed to phthisis in 1886 give a ratio of 3891 per million. Although these figures cannot be accepted as accurate, yet they may fairly be taken as proving the frequency and fatality of consumption in the Colony.

Convulsions, which probably includes apoplexy and other diseases, are extremely fatal, the deaths being in the ratio of 4177 per million. It is well known that malaria frequently manifests itself in children by inducing fatal convulsions, and the malarious element, no doubt, increases the mortality under this head.

Hepatitis and *Congestion of the Liver* gave rise to 23 out of 1269 admissions into the Civil Hospital in 1886, and abscess of the liver to 2 admissions only. This does not indicate any high degree of the prevalence of these affections.

Rheumatic Fever is rather common, at least among the European population.

Leprosy is met with, but it does not prevail to any large extent.

Beriberi.—Four cases of beriberi were treated in the Civil Hospital in 1886, but these were imported cases. Four cases of paralysis of the lower extremities, possibly a manifestation of beriberi, were also admitted. Beriberi is thus not a common disease in Hong-Kong.

Syphilis and non-syphilitic venereal diseases are of frequent occurrence among the population.

A large proportion of the population of Hong-Kong live in boats. If the accuracy of the returns could be depended upon, this section of the population suffers to a smaller extent than the land population from fever, bowel complaints, and chest affections.

CHAPTER V.

JAPAN.

Geography.—Japan comprises the four large islands, Yeso, Nipon, Shikoku, and Kiusiu, with some thousands of smaller islands and islets.

Japan is of volcanic origin. The mountains generally are of moderate elevation, and the country is diversified with fertile valleys, lakes, and rivers. The greater part of the southern islands are closely cultivated by a numerous and industrious population, which in 1887 reached 39,069,007. The population of the northern island, however, is sparse, numbering only 239,566. Nipon has a population of 30,005,322; Shikoku, of 2,802,666; and Kiusiu, of 6,021,455.

Although our knowledge of Japan and its inhabitants has increased very much since it was reopened to Europeans in 1854, our information respecting the climate and diseases of the different islands is still general rather than precise; but during late years our knowledge of the country has been greatly increased by the researches of Europeans residing in the country.

Climatology.—The following table, from Rein's work on Japan, gives the temperature and rainfall of a number of districts stretching from 26° to 41° N. latitude:—

Locality.	Lat. N.	Mean of Winter.	Mean of Spring.	Mean of Summer.	Mean of Autumn.	Annual Mean.	Rainfall.
	° ′ N.	C.°	C.°	C.°	C.°	C.°	
Hakodaté (Yéso), .	41 46	− 1·3	6·6	18·5	11·7	9·2	1 m. 318
Sapporo (Yéso), . .	43 04	− 1·8	5·6	19·7	9·8	8·3	1 m. 053
Nihigata, ...	37 55	1·9	10·8	24·0	15·0	12·9	...
Osaka, ...	34 20	6·2	13·7	25·3	19·0	16·0	1 m. 054
Yokohama, . . .	35 17	5·1	12·9	23·2	16·2	14·3	1 m. 794
Yédo, ...	35 41	3·6	12·5	24·0	14·6	13·9	1 m. 671
Nagasaki (Kiusiu), .	32 41	6·5	14·7	25·0	18·3	16·1	1 m. 212
Nafa (Lieou Kieou),	26 13	16·7	20·8	27·5	24·5	22·3	...

The range of temperature throughout Japan is very considerable. The changes are sudden, and may attain 14° or 15° C. within a few hours.

In Japan there is no dry season; rain falls every month, but is most abundant, as a rule, in summer, at the beginning and end of the hot season. On the west coast of Nipon the period of greatest rainfall is from September to December.

At Tokio the months of greatest mortality are July, August, September, and October; the months of minimum mortality are April, May, and June.

PATHOLOGY.—I have received from Dr. Bally, professor at the Imperial University, a short account respecting the prevalence of malarial fever, typhoid fever, and dysentery in Japan, which I shall reproduce:—

"*Malaria.*—The disease is prevalent all over the lower districts of the country, but places where it is severely epidemic are very few. One instance of such regions is the lower valley of the Oi river, where, in a district inhabited by 50,000 people, more than one-third of these are reported to have been attacked in one year.

"Other districts where the disease is unusually frequent, are the environs of Kōchi, in the province of Tosa, and the districts round Kumamoto, in Higo (Kiusiu).

"But even in these districts the disease is of a mild type, and during the thirteen years of my sojourn in the country I have never seen any case of the pernicious or remittent form, and I am told that other physicians have had the same experience.

"*Typhoid Fever* is prevalent in Tokio in about the same degree as in the capitals of Europe, and altogether takes the same course as there. Yet the following is to be observed: Diarrhœa is the exception, not the rule. Delirium, or other severe nervous symptoms, rare. Hæmorrhages from the bowels are frequent and dangerous."

Vincent[1] states that enteric fever is most common in autumn, when the ground is drying after the rains. But it will probably be found to prevail in autumn, even in those districts in which the maximum rainfall occurs later. It has notably diminished in Yokohama since the town was drained. In the *Navy Report* for 1885 we find that 18 men contracted fever at Nagasaki. The symptoms were not well defined, but the autopsy of one of the fatal cases revealed the lesions of enteric fever. The type of typhoid fever in Japan will be seen to approach that which we have found to be common in India.

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[1] *Archiv. de méd. nav.* vol. lii.

Typhus Fever is occasionally observed. In 1881 a rather severe outbreak occurred at Tokio and Yokohama, but it has since almost died out.

River Fever. A disease peculiar, so far as is known, to Japan, is described by Vincent under the name of *Fièvre Fluviale.* Its native name is Tsutsuga or Shimamushi. Its area is circumscribed, as it is met with only in some districts on the western side of the islands, as in the valley of the Shinanogawa, the banks of the Udagawa, and those of the Omonogawa. It is a disease of river banks or of inundated lands. It is characterised by rigors, fever (temperature 38°–39°·5), with slight morning remissions, followed by the appearance of one or several small, round, dark spots, which become converted into eschars, and then into crateriform ulcers. These are met with in the groin, axilla, upper part of arm or thigh, or on the scrotum. The neighbouring lymphatic glands enlarge, but do not suppurate, and the surrounding skin is not discoloured. In bad cases the swelling extends to all the superficial lymphatics. At the end of the first week an exanthem appears, characterised by lenticular, rose-coloured papules. These appear first on the temple and cheeks, then on the trunk and extremities. The mind, in the milder forms, remains clear, but the patient complains of intense headache. In grave cases there are delirium, coma, and intestinal hæmorrhage. The urine is not albuminous. From 12 to 15 per cent. of the cases prove fatal. The spleen is slightly enlarged, there are no local lesions to be observed in the intestinal canal. The heart and lungs present nothing special.

No trace of the larvæ of insects about the primary eschars has been found. It is a disease of summer; August and September are the months during which it is most prevalent (Vincent).

Diphtheria broke out in an epidemic form in Yokohama in 1877, and was again observed in the same town in 1881 and 1882. Since that time diphtheria has been frequently noticed in Tokio and in many other parts in the interior of Japan.[1]

Dysentery.—"There are official statistics about dysentery published by the Central Sanitary Bureau, but they are quite unreliable, as certainly most of the cases are not reported. There are sporadic cases of dysentery in Tokio every summer, but I have never witnessed anything like an epidemic, although such are reported from time to time from some districts; but there is no part of the country where it is endemic, as in the tropics." (Bally).

Cholera is said to have been entirely unknown in Japan before the year 1822, when it was introduced from China, according to

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[1] *Archiv. de méd. nav.* vol. lii.

Hirsch, or from Java, as is affirmed by Vincent. Its next outbreak was in 1831. This time it was probably introduced from China. It was then absent from Japan until 1842, when it again broke out, but was apparently limited to a few points in the north. Sixteen years later, viz. in 1858, it was introduced from China into Yokohama by the American frigate *Mississippi*, and caused a terrible destruction of life. In Tokio alone 100,000 persons were carried off within a month, and it was not completely extinguished for three years. It is doubtful if it was epidemic in Japan in 1864 and 1865, as is stated by Hirsch; but in August 1877 it was imported from Amoy into Nagasaki, and spread rapidly all over the country. In 1879 it is said to have carried off 97,422 victims. Since then it has been endemic in the country,—sometimes latent for a time, then breaking out with renewed virulence. Vincent says that at the present day cholera is, without doubt, the disease which commits the greatest ravages amongst the Japanese.

Smallpox is one of the most widely diffused and fatal epidemic diseases of the country.

Measles occurs in severe epidemics; that of 1862 caused at Tokio alone more than 60,000 deaths.

Scarlet Fever is excessively rare.

Phthisis was rather a rare disease among the English troops while stationed at Yokohama, but it is said to be more frequent at Nagasaki. From the incidental remarks of those who have visited or resided in the country, consumption appears to occupy very much the same place in the pathology of Japan as it does in that of Europe. It is met with, more or less, in all districts.

Pneumonia and Bronchitis are common diseases of the natives in all parts of the country, north and south. Pleurisy is less frequently observed. Bronchitis is particularly fatal to children. Respiratory diseases are said to be most common in spring and summer.

Rheumatism, of a chronic or sub-acute form, is very prevalent in Yeso. It is one of the most common diseases in Yokohama,[1] and it is far from rare at Nagasaki, in the southern island of Kiusiu; but *Acute Articular Rheumatism* is very rare at Tokio and Yokohama.

Heart Disease is rare at Tokio. At Yokohama, Nagasaki, Kobi, and Hiogo, cardiac affections are more common; and pericarditis is more frequent than endocarditis.

Hepatitis occurs with moderate frequency in the southern islands;[2] but even in these it does not take the prominent place among the fatal diseases that the comparatively high temperature of these localities might have led us to expect. In the north of Nipon, and in Yeso, inflammation of the liver is seldom seen. The cases of abscess which are met with occur mostly in foreigners.

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[1] *Army Medical Report*, 1866.

[2] Maget, *Archiv. de méd. nav.* vol. xxvii.

Beriberi, or Kak-ke, as it is here called, finds in Japan one of its chief endemic centres. It is met with in all the islands, from Hakodaté in Yeso in the north to Kiusiu in the south, and in the interior as well as along the coasts. The extent to which it prevails may be estimated by the fact stated by Hirsch, on the authority of Scheube, that in 1877 a ratio of 14 per cent., and in 1878 no fewer than 38 per cent., of the army suffered from the disease. Beriberi is very prevalent in the mining districts of Kiusiu. Women are less liable to it than men in the ratio of 1 to 31·7, the young and the old than those of middle age.[1] At Tokio the disease is most prevalent from April to September,—the maximum falling in July and August, and the minimum in December, when it almost becomes extinct.

Syphilis is extremely prevalent throughout the whole of Japan, as is proved by the frequency with which the tertiary forms are observed among the natives. The deaths from syphilis, according to Vincent, form 6·48 per cent. of the total mortality. Venereal affections were notably common among the troops stationed at Yokohama.

Leprosy is perhaps nowhere more generally diffused at the present day than in Japan. Here we read of villages where every inhabitant is affected with the disease. No region is exempt from the malady. The districts most severely affected are the Bay of Nagasaki, the Bay of Yeddo, Miako, and Oruma. The Lieou-Kieou (Loo-Choo) islands enjoy an immunity from this disease. (Hirsch.)

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[1] Of 333 male patients treated by Scheube in 1877–78, no less than 46 per cent. were scholars, priests, teachers, or writers, while 41 per cent. were in business, and 13 per cent. were artists or artificers. The conclusion which Scheube draws is, that those occupations predispose specially to the disease which involve a sedentary life. (Hirsch.)

CHAPTER VI.

THE EASTERN ARCHIPELAGO.—SUMATRA, BANCA, BILLITON, THE RIOUW ARCHIPELAGO.

GEOGRAPHY.—Sumatra, separated from the Malayan Peninsula by the Straits of Malacca, extends from 5° 45′ N. to 5° 50′ S. lat. It is 1040 miles long, by 266 in its greatest breadth, and has an area of 168,000 square miles, with an estimated population of about 5,000,000.

The Barisan range of mountains, having an elevation varying from 1500 to 6000 feet, skirts the west coast, towards which it sends down numerous spurs. Other parallel ranges to the east are connected with the main chain by transverse ridges, separated from each other by elevated valleys. Active volcanoes exist in those ranges. The western coast belt is narrow, and the rivers short and rapid. On the east, alluvial plains, covered with forest and jungle, extend inwards to a great distance. This coast is flat and low, and is in many places inundated by the sea. The rivers flowing to the east coast are numerous and sinuous, forming deltas at their mouths.

The Lampongs Residency in the south, between 4° and 6° S. lat. and 104° and 106° E. long., is low and flat, with extensive alluvial deltas. The name Lampongs means "floating on water," and indicates the frequency of inundations. This part of the country, it need scarcely be said, abounds in marshes and stagnant water. The interior of this part of the country is covered with dense forests.

The Palembang Residency in the south-east, lying between 0° 47′ and 5° 15′ S. lat., and 101° 25′ and 106° 3′ E. long., is liable to inundation in the low lands and near the deltas. The soil is fertile and watered by numerous rivers, the principal being the Moesie or Soensang.

CLIMATOLOGY.—According to Van Leent,[1] to whom we are chiefly indebted for our knowledge of the medical topography of the island,[1] the mean temperature C. of the east and west coasts is as follows :—

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[1] *Archiv. de méd. nav.* vol. xvii.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
West Coast, . .	26·46	26·51	26·76	26·55	26·98	26·81	26·50	26·29	26·45	26·14	26·18	26·25
East Coast, . .	26·49	26·67	27·05	27·07	27·28	26·84	26·69	26·63	27·22	27·16	26·95	26·58

The climate is thus warm and equable, the mean daily range seldom exceeding 5° C.

There is no dry season in Sumatra. Rain falls every month, and the annual fall is very heavy. On the west coast the rainiest months are October and December, then November and March; the driest are July and September. The semi-independent State of Atcheen, on the north, has the period of heaviest rains from May to November.

PATHOLOGY.—*Malaria* is more or less prevalent all along the west coast.

Intermittent Fever prevails at Tapanuli, where there are extensive marshes. Singkel is also notoriously unhealthy. Padang, although not free from fever, is more salubrious.

Malaria is the dominant disease in the Lampongs. Those who have to work in the marshy forests are affected with tertian fevers, accompanied by gastric and bilious complications. The prostration is extreme, the emaciation excessive, the spleen is enlarged, the skin dry, cold, and pale, the belly tumefied, and constipation obstinate. The deaths from malaria in this province often amount to half the total mortality.

Fever, although less common than in the Lampongs, is the prevailing malady in the plains of Palembang, and also in the north, where the Dutch troops in their recent campaign in Atcheen suffered greatly from marsh fevers. The high lands of the interior are healthy.

The endemic fever of the Lampongs is said by Van Leent to be intermittent at the outset, soon becoming remittent or continued. It is often complicated with grave nervous and bilious affections, and pernicious attacks are not uncommon. It is rare that a European who resides long in this district escapes the malady. In the Palembang Residency the prevailing fever of the low country is intermittent. Pernicious forms are rare here.

Typhoid Fever is not unknown. It is not unlikely that many cases of enteric fever are mistaken for malarial fever.

Cholera has frequently prevailed in an epidemic form in Sumatra. It was one of the maladies that told most heavily on the Dutch troops during their protracted operations in Atcheen.

Dysentery is common in Sumatra, especially in the Lampongs country, where it is often complicated with bilious disorders. In the Palembang district it is, as a rule, mild; but it has sometimes been observed to assume an epidemic form. It was also one of the more fatal diseases among the troops in Atcheen, where, out of 8517 cases of sickness, dysentery accounted for 558 among the Europeans and 252 among the native soldiers. Upon the whole, however, dysentery is less fatal in Sumatra than in Java and some of the neighbouring islands.

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[1] *Archiv. de méd. nav.* t. xxii. et xxvii.

Diarrhœa is said to be very common in the Lampongs during the drier months.

Smallpox, which was formerly destructive amongst the natives, has recently been considerably restricted in its ravages by the spread of vaccination.

Measles of a mild type is occasionally epidemic, but *Scarlet Fever* appears to be rare or unknown.

Pulmonary Catarrh and *Asthma* are of rather frequent occurrence.

Pneumonia and *Inflammatory Diseases* of a frank character are seldom seen. Of an adynamic type they are more frequent.

Phthisis is rare; but when it does occur, it is observed to run a rapid course. *Scrofula* is very common among the poor in the northern part of the Lampongs Residency.

Hepatic Affections of a grave character, except as complications of fever, are comparatively rare; but the milder forms are common in the Lampongs, and they are said to be increasing in frequency in Palembang. When the troops in Atcheen were being decimated by fever, cholera, and beriberi, it was observed that hepatitis, and liver diseases generally, were by no means frequent.

Leprosy is excessively rare in the Lampongs; it is more frequently seen in Palembang. It is also met with, and to a greater extent, in the elevated regions of the interior, especially at Paya-Combo. (Hirsch.)

Heart Diseases are pretty common, except in the Lampongs, where they are seldom seen. *Rheumatic Affections* and *Dropsy* are rife, especially in the Lampongs.

Goitre, according to Hirsch, is endemic in some districts of Lepoetie and Toelang-Bawang, especially in the Aboeng country, and along the banks of rivers where there is abundance of calcareous salts. Van Leent, referring to the province of Palembang, says "the number of persons affected with goitre is remarkable."

Syphilis causes terrible ravages amongst the native races of Palembang. It is frequent also on the Lampongs coast.

Beriberi is of frequent occurrence in the Lampongs, and was one of the fatal diseases among the troops in Atcheen. To what extent it prevails in the other districts I have not learned.

Frambœsia is endemic in Sumatra.

BANCA.

Banca lies off the south-east coast of Sumatra, from which it is separated by the Strait of Banca. The population of the island is estimated at 49,500.

The climate is excessively humid. The capital is Muntok. The mouths of the rivers and streams are marshy, as is the right bank of the river Muntok.

Malaria.—The most common disease in this island is intermittent fever, generally of the quotidian type, which is met with throughout the year. Pernicious and masked forms are not wanting.[1] It is noticed that the Chinese and Malays who live in the midst of the marshes do not suffer much more than those who live in non-marshy localities. Pernicious fevers were epidemic in 1824–25.

Diarrhœa is common, but mild; whereas *Sporadic Cholera* makes many victims.

Dysentery of a severe type is frequently met with as a sequel of diarrhœa, or as a complication of fever.

Diseases of the Liver amongst the Europeans are rare; cases of abscess do, however, occur occasionally.

Epidemic Cholera made its first appearance in this island in 1852.

Beriberi is of frequent occurrence amongst the mining population.

Syphilis, Leprosy, and *Yaws* are remarkably rare in this island.

Elephantiasis is widely diffused among the native population.

BILLITON.

Billiton, a small island between 2° 30′ and 3° 17′ S. lat., has an area of 2500 square miles, and a population of 12,384.

The rains are abundant, the atmosphere humid, and the dews, after a clear day, excessive.

The island is moderately healthy. The Dutch troops in garrison, or those detached for service near the mines, suffer pretty frequently from malarial fever, being exposed to the night air when on guard.

Beriberi appeared for the first time in 1856, when it broke out amongst the mining population. Since 1862 it has considerably diminished in frequency.

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[1] *Archiv. de méd. nav.* vol. xix.

Syphilis is rarely seen in this island, and is chiefly imported by foreign sailors.

THE RIOUW ARCHIPELAGO.

This group is situated between Malacca, Sumatra, Banca, and Borneo. The islands vary much in elevation, but the inhabited districts are not more than 150 feet above the sea-level. Rains are frequent all the year ; the temperature is high, and liable to sudden changes.

Intermittent Fever of a mild type is of frequent occurrence.

Dysentery and *Hepatitis* are seldom met with. *Rheumatismal* and *Catarrhal Affections,* on the other hand, are very prevalent.

Syphilis is frequent, and *Frambœsia* is moderately common. The perforating ulcer of the foot, called *Sakith-blah,* is frequently observed amongst the indigenous population.

Leprosy.—In the isle named Sengarang there are about thirty Chinese lepers ; a few cases are also met with among the Chinese labourers in the islands of Lingga and Linkeh.[1]

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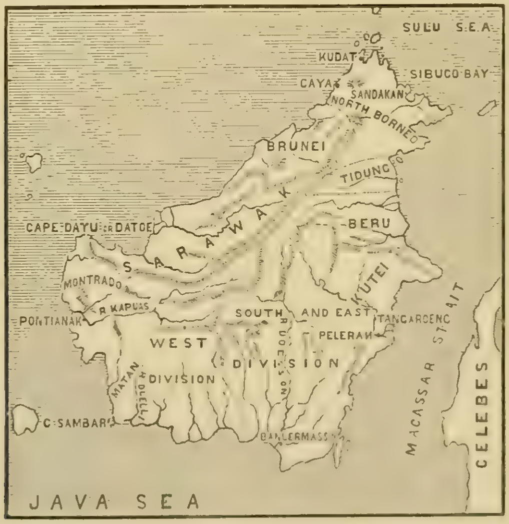
[1] Van Leent, *Archiv. de méd. nav.* vol. xix.

CHAPTER VII.

BORNEO.

Borneo, the largest island of the Eastern Archipelago, extends from 7° N. to 4° 20′ S. lat., and from 108° 40′ to 119° 46′ E. long. It is about 800 miles long by 700 miles in breadth, having an area of about 300,000 square miles, and a population estimated at 2,000,000. A central mountain mass sends off radiating chains, towards the littoral, in different directions, between which lie extensive plains watered by innumerable rivers. A central ridge, with peaks ranging from 4000 to 8000 feet, forms the water-shed of the northern part of the island. The coast country is to a great extent marshy, especially during the rainy season.



BORNEO.

The eastern, southern, and south-western shores are in the possession of the Government of the Netherlands. The northern extremity is under the rule of the North Borneo Company. The

British protectorate, extending down to the north-western side of the island, includes Bruneï and Sarawak.

GEOGRAPHY AND CLIMATE OF KUTEI.—The Dutch province of Kotey or Kutei extends from 1° N. to 1° 3′ S. lat. The delta of the river Koetei or Mahakan is alluvial, and its borders marshy. At a distance of five leagues from the coast, upon the right bank of the river, is Peleran, where there are coal mines which are worked by the Government; and three leagues higher up the river is Samarinda, the capital of the district.

Rains are frequent throughout the year; but from January to April they are often torrential, causing extensive inundations of the adjacent country. The temperature is high, but liable to sudden vicissitudes. Mists hang about the valleys at night.

PATHOLOGY OF KUTEI.—*Malarial Fevers* abound in this district, and pernicious forms are not uncommon. Van Leent enumerates, as causes of the frequency of fever, the humidity, the oscillations of the temperature, the frequent inundations, and for Peleran, above all, the upturning of the soil consequent upon the mining operations.

Smallpox has often appeared in this province in an epidemic form.

Dysentery and *Hepatic Affections* are by no means frequent. Enlargement of the *spleen* is common.

Beriberi is also met with. It is said to have made its first appearance in this region on board the Netherlands ship of war *Padang* in 1851.

Leprosy is met with, but it is not common.

GEOGRAPHY AND CLIMATE OF BANJAR-MASIN.—The seat of Government of the southern province is Banjar-Masin, a little to the east of the Banjar or Barito river. The immense marshy plains watered by the Doesson, the Barito or Banjar, and smaller rivers, form the principal feature of this region. The temperature sometimes reaches 37°; a temperature of 33° or 34° C. is common. The rains are heavy and frequent. The number of rainy days in the year is usually about 190. Fogs, too, are frequent.

PATHOLOGY OF BANJAR-MASIN.—*Malarial Fever* is the predominating disease, but is neither very severe nor obstinate. Relapses are not frequent.

Remittent Fever with bilious complications, and of an adynamic character, is pretty frequently met with. The existence of *Typhoid Fever* is doubtful.

Diphtheria does not appear to have been observed up to 1872, nor have I met with any accounts of its appearance since that date.

Dysentery is by no means a common affection at Banjar-Masin and when it does occur it is generally of a mild type.

Diarrhœa, on the other hand, is of frequent occurrence.

Cholera is not endemic in the province; but when Van Leent wrote (1872), Banjar-Masin had suffered from four epidemic outbreaks of the disease.

Smallpox shows itself from time to time in severe epidemics.

Measles, which in warm countries often assumes a mild type, tends here to become complicated with diarrhœa or dysentery, and causes a considerable mortality.

Whooping-Cough is mentioned amongst the epidemic diseases of this province.

Catarrhal and *Bronchial Affections* are of frequent occurrence.

Pneumonia is by no means rare, and rapidly assumes an asthenic form.

Consumption is not uncommon.

Hepatitis is chiefly met with amongst Europeans who abuse spirituous liquors, while the natives suffer little from the disease.

Leprosy is widely spread amongst the Dyaks.

Elephantiasis, perforating ulcer of the foot, and frambœsia are endemic in the province.

Syphilis, formerly rare, has of late years been increasing in frequency.

Scrofula is common throughout the island.

Ophthalmia affects whole tribes. A species of ringworm, called *Kurab,* is very common in many parts of Borneo.

Geography of Western Province.—The Western Province comprises the west coast line from 2° N. to 3° S. lat.; that is, from Cape Datoe to Cape Sambar, and the stretch of the south coast to the mouth of the river Djellei. The seat of government is Pontianak. Two great rivers flow through this region—the Sambas and the Kapoeas.

The temperature in November, December, January, and February varies from 26°·5 to 28°·6 C.; from March to September it is higher, attaining sometimes 30° or 31° C. The heaviest rains fall from October to February. This is what is called the bad season—the season marked by great humidity of the atmosphere and sudden changes of weather.

Pathology of the Western Province.—Bronchitis, pneumonia, and catarrhs prevail during the rainy season; but it is in the drier and warmer season, from March to September, that fevers and dysentery, the latter of which is here prevalent and severe, are most frequent, fevers being specially common in the months of April and September, at the changes of the season, and it is then that pernicious cases generally occur. Beriberi is met with here among the mining population, but it is not common.

GEOGRAPHY OF NORTH BORNEO.—On the north-west coast we have Sarawak, where Sir James Brooke laid the foundation of a new State. The country, although notably subject to malarious diseases, compares not unfavourably, in respect to salubrity, with many parts of the East. Passing Bruneï, of which little is at present known,[1] we come to the north part of the island, belonging to the North Borneo Company. This region is divided as follows:—Keppel Province stretches along the north-west coast from Kimanis Bay northwards; Alcock Province occupies the north and north-east; the East Coast Residency lies south of Alcock Province, and stretches down the coast to the 4° N. lat.; Dent Province, in the south, runs nearly half across the island between Bruneï Bay on the south and Keppel Province on the north.

Dr. Lamb has furnished me with the following description of the country:—North Borneo is at present one enormous jungle, interrupted here and there by clearings of a few acres made by the natives for the purpose of cultivation. These clearings are most numerous on the west coast, where the wet and dry methods of rice cultivation are alike practised. On the east coast the dry culture alone is carried on. The coast line is very deeply indented by bays and inlets of the sea, and is in most parts swampy, the swamps being mostly of mangrove. In some places it is sandy, covered with casuarina trees, often with a mangrove swamp some little distance inland. High land is sooner reached on the west than on the east coast; the swamps are thus of less extent in the west.

CLIMATE OF NORTH BORNEO.—The following are the mean temperature, range, and rainfall of Sandakan, on the north-east coast, for 1887:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Mean Temperature F., .	79·82	80·02	80·18	81·65	82·36	80·76	82·66	81·06	82·00	81·56	81·15	79·38 =	81·01
,, Range F., . .	9·68	8·57	10·65	10·62	12·38	12·30	13·70	13·58	14·25	13·26	11·82	10·08 =	11·74
Rainfall (inches), .	29·35	18·30	12·95	5·26	2·55	5·56	4·48	6·33	12·27	9·18	8·76	32·47 =	147·47

The mean annual temperature is nearly the same at all the stations, varying from 84°·35 at Silam to 86°·60 at Kudat.

The rainfall ranges along the coast from 90 inches at Silam to 147 inches at Sandakan.

It would appear that the rainy season extends from December to March on the north-east coast, and also on the north at Kudat. On the north-west coast the rainfall is nearly as heavy as at Sandakan, but is more equally spread over the year—April, May, June, and November being the rainiest months.

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[1] Talairach, probably not from personal knowledge, says that paludism ravages the north coast of Borneo, especially the States of Bruneï and Sarawak, at the changes of the monsoons.—*Archiv. de méd. nav.* Nov. 1885.

PATHOLOGY OF NORTH BORNEO.—*Malaria.*—No part of North Borneo is entirely free from malaria. In the high grounds in the interior, however, where dry cultivation is carried on, there is little fever at any season. The districts which have been for some time opened, such as Sandakan, Kudat, and Gaya, are also comparatively healthy. The coast line generally, especially where swampy, is malarious; that part which extends to the south from Sandakan harbour to Segama river is particularly unhealthy. The Bajows, a seafaring people, frequent these places, and the great majority of them suffer from chronic malarial poisoning. Life in the jungle, provided it is not disturbed, is not unhealthy; but no instance is known of any one failing to be attacked with fever, sometimes with severe remittent, immediately after coming out of the jungle. At Sandakan the excess of disease takes place in September, October, and November,—the period of heavy rains, chiefly nocturnal. The true rainy season—December to March—is very healthy. At Kudat, which is a flat sandy plain reclaimed from the sea, with coraline rock below, the disease is most common on the drying up of the rains after the rainy season.

Gaya, a small hilly island, experiences an excess of the disease at the change of both monsoons; the malarious infection is thought to be derived from the mainland, which is only one to two miles distant.

In the districts of Bundu, Putatan, and Papar, where the rice is irrigated, malaria prevails in the ploughing months of July and August.

The opening of the jungle is followed by a considerable mortality among the labourers, but after a short time the fever subsides. Where the jungle so broken up is marshy, and subject to inundation, the type of fever is more virulent than where the soil is porous and drier. Fever usually attacks the coolie within a month or two of his arrival, but should the soil be inundated its appearance is delayed.

Intermittent fever of the quotidian and tertian types is most common. Mild remittent is occasionally met with. Severe remittent is seen chiefly on tobacco estates. Yellow malarious fever, with hæmoglobinuria, beginning as a remittent, passing after a week into intermittent, accompanied by anæmia and dropsy, has occasionally been observed.

Dropsical Affections are very common. There is a form which appears after a few slight attacks of intermittent fever, and is unaccompanied by any other obvious symptom except scanty urine; this kind of dropsy is very amenable to treatment.

Intense anæmia, with intercurrent attacks of dropsy (wet beriberi), is also very common. The dropsy, reappearing from time to time, gives rise to great debility and death, which may result from exhaustion; it is very often preceded by convulsions and coma, or by an intractable diarrhœa or dysentery. This disease, which is not improbably malarial, must not be confounded with the true beriberi, of which paralysis, as well as dropsy, is a leading symptom.[1]

True *Beriberi* is also frequently met with in North Borneo. It is more prevalent on the east than on the west coast, and those who have previously suffered from fever or dysentery are specially liable to be attacked. In Borneo it is considered to be essentially a jungle disease. The coolies who work on the estates frequently contract the disease after a residence of from three to six months. Beriberi is one of the most mysterious diseases in the nosology. Its nature and causation are alike unknown, and their investigation is rendered still more difficult by the loose way in which the term is applied. It is confounded with anæmia and dropsy (without paralysis), a condition which is often styled wet beriberi, although the symptoms may not have the slightest relation to that disease. Anæmia and dropsy are often the result of malaria, of anchylostoma duodenale, and of numerous other conditions. Then there is a disease, which I have described as *Acute Anœmic Dropsy*,[2] which was prevalent in Assam and Lower Bengal in 1877–80, and which was introduced from India into Mauritius in 1879—a disease running a course of from three to six weeks, characterised by rapidly developed anæmia and dropsy, accompanied with very slight fever, and generally ending in recovery. This singular malady has been confused with beriberi, from which it differs in many respects, especially in the absence of paralysis, in its more evident transportability by human intercourse, by its attacking almost the whole population of certain districts, and by the much smaller mortality to the number affected.

Dysentery is very common, both as an idiopathic disease and as a complication of fever, in North Borneo, but it is not of a malignant type, and, as a rule, is amenable to treatment.

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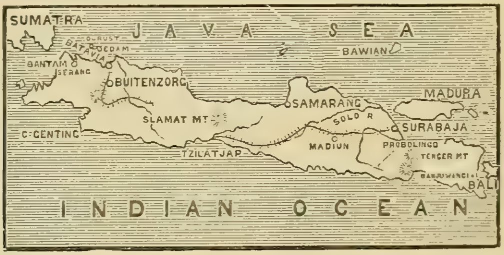
[1] For an account of beriberi in Labuan, see *Army Medical Report* for 1869.

[2] *Edinburgh Med. Journal*, 1881.

CHAPTER VIII.

JAVA.

Geography and Climatology.—Java extends between 5° 2′ and 8° 50′ S. lat., and between 105° 12′ and 114° 39′ E. long. It is 600 miles long by 50 to 140 broad. The island is mountainous, some of the peaks attaining an elevation of 9000 feet. Madura, an island 90 miles long by 24 broad, is situated off the north-east coast of Java.



JAVA.

Batavia, the capital of Java, is situated at the mouth of the Sjiliwong river. The population of the city in 1885 was 92,193, and that of the province nearly a million. The population of the islands of Java and Madura is estimated at 19,000,000.

The monthly mean temperature F., and average monthly rainfall, in inches, at Batavia are as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	77·48	77·52	78·24	79·34	79·59	78·83	78·25	79·14	79·35	79·50	79·23	77·86
Average Rainfall, .	21·01	18·5	9·4	5·9	4·4	4·9	2·9	2·5	3·8	6·2	6·4	14·2

On the highlands of the interior the temperature is much lower than on the coast, and the climate is more bracing and healthier.

Pathology.—*Malaria.*—Batavia was formerly highly malarious, but of late years the result of drainage and other sanitary improvements has been to render it comparatively healthy; but the banks of the river in the neighbourhood of the city are still excessively malarious, pernicious forms being far from rare. The north coast generally is low, marshy, and covered with luxuriant vegetation. In this part of the island intermittent and remittent fevers prevail during the dry season, June, July, and August. Pernicious attacks are also common. In 1874, malarial fevers formed 242 per 1000, or nearly one-fourth of the cases treated, and 60 per 1000 of the deaths, among the civil population of Java and Madura. The Europeans are most liable to malarial affections; the Javanese suffer to a less extent, except when the disease is epidemic; the Africans enjoy a comparative immunity from malarial fever. Hirsch enumerates Onrust, Buitenzorg, Sourabaya, Madura, and Banjuwangi, to which we may add Anger, in the Bantam Residency, among the districts specially affected with malaria. Fever of a severe type is rare at Passaroeang in the east. Those who are attacked at Probolingo and Bezakie often recover when removed thither. Tjilatjap is also free from fever in its severer forms. The quotidian type is that which is most frequently met with; tertians are rare, and quartans exceptional. The higher lands of the interior are healthy.

Malaria occasionally assumes an epidemic form in Java, and the island of Onrust has been specially liable to such outbreaks. The epidemic disease affects the acclimatised native as well as the foreigner, and extends to districts in which the endemic disease is little felt. Certain cycles of years, such as 1840–50, are marked by a high fever mortality.

The English expedition to the Batavian Roads in 1800 suffered terribly from fever, which presented symptoms so seldom seen in such outbreaks that it may not be out of place to give a short account of it.

The troops first took possession of the small island of Onrust, about 3 miles from the mainland. Here endemic fever began to appear. It was thought that the island of Edam, situated 9 miles out to sea, would prove more healthy, and the sick were ordered to be removed thither on the 28th September; and here, as Shields says, the tragic tale commences.

Of 60 soldiers (12th Regiment) landed at different times, in health, to do duty at Edam Hospital, between the 1st October and 12th November, 31 died (besides 5 or 6 who died at Onrust previously); of the remaining 29 who embarked on the breaking-up of the blockade (12th November), 22 died at sea; the other 7 were sent to Malacca Hospital, where all, or nearly all, shared the same fate. The whole detachment originally numbered 127 men. Of these only 62 returned, the rest having fallen ingloriously without drawing a sword.

Sixteen marines were landed from the *Centurion* to do night-duty. The whole of these were seized with fever, and 13 of them died. Nine officers, including the surgeon (Mr. Cornish), who were doing duty at this island, perished. Twenty-five men belonging to the 12th Regiment, who remained on board the *Dædalus*, and did not land, entirely escaped the fever.

Onrust is described as a small island, 3 miles from the mainland, well cleared, nearly flat, and free from swamps or marsh, with the exception of one very small spot, which, however, is said to have been covered twice a day by the tides. Edam was covered with trees, long grass, and jungle, a part of it being in a marshy state.

The leading symptoms of this epidemic endemy were—Giddiness, chills, debility, vomiting, supra-orbital and epigastric pains. Sometimes the patient fell down insensible, his body covered with cold sweats, except at the pit of the stomach, which always felt hot. Then succeeded flushings, increased pain of head and epigastrum, retching, vomiting of bilious matters. This lasted from six to eighteen hours, and was generally succeeded by rigors, and very often by low delirium, preparatory to the next paroxysm of fever. The mind became clouded. If asked, "How are you?" the common reply was, "Very well." This was a dangerous symptom. Some patients on shore were carried off in from eighteen to forty hours, others not until as many days. A great proportion changed in a few days to a bright yellow colour, some to a leaden colour; other cases terminated fatally in a rapid manner without any jaundice. Vomiting of black bilious stuff, resembling the grounds of coffee, commenced early, and continued a most distressing symptom.

The pupil of the eye was often dilated, and did not contract on exposure to a very strong light; in other cases there was great intolerance of light. Low delirium was pretty constant; sometimes there was raging delirium. Some patients were comatose from the first attack; in others the fever was ushered in with convulsions, delirium, and cold sweats, without any heat of surface except at the pit of the stomach.

Hæmorrhage from the mouth or nose seldom occurred; deafness was a constant and bad symptom. Aphthæ, subsultus-tendinum, eruptions about the mouth, locked jaw, were all symptoms noticed in individual cases. When the eruption about the mouth presented the appearance of small black or brown spots, this was regarded as a fatal symptom.[1]

Typhoid Fever is said to be rare in Java; but Hirsch has shown that from 1865 to 1878 the total number of cases reported as

[1] *Endemic of Batavia*, by W. Shields. Johnson's *Tropical Climates*, Lond. 1827.

occurring among the Indo-Dutch troops, stationed in Java and Madura, was 662, of which 262 ended fatally. Besides these, a considerable number of cases of gastric and bilious fever were observed, some of which were doubtless cases of typhoid fever. It is probable, therefore, that in some districts of Java typhoid fever is by no means so rare as is generally supposed.

Dengue visited Java in 1872–73, and it was observed mostly to attack "the occupants of two block-houses, occupying a particularly unhealthy site, without distinction of race, rank, age, or sex; while those who were better housed, under more favourable conditions, enjoyed a striking exemption" (De Wilde, quoted by Hirsch).

Diphtheria was epidemic in Sourabaya and Batavia in 1881.

Cholera is no recent visitor in Java, for Bontius observed and described an epidemy of the disease in that island as far back as 1629. The pandemy of 1817–23 reached Java in 1820, and caused a great mortality, lingering on for several years. I am not aware if Java suffered during the second and third pandemics, but the disease was again epidemic in 1852, 1864, 1865, and in 1874; and on all of these occasions it made great ravages, especially amongst the Javanese and Chinese.

Dysentery is endemic to a large extent in Java, where it is estimated to cause a third of the total mortality. It is especially severe at Sourabaya, is very common at Batavia, and somewhat less so at Samarang, where it causes a death-rate of 16·2 per 1000 among the Europeans, and 7·7 among the natives (Hirsch). It is less frequent at Banjuwangi and Passaroeang. It is a frequent complication of fever. Europeans, particularly those who have recently arrived, are much more liable to contract the disease than the natives.

Diarrhœa in all its forms, bilious and catarrhal, is common, and is very fatal to European children.

Smallpox, at the present day, is much less prevalent than in the past, when vaccination had not become so general amongst the natives. *Measles* is known, but mild. *Scarlet Fever* is unknown.

Pneumonia, Pleurisy, and *Chest Affections* generally are exceedingly rare in Java.

Phthisis is met with to a considerable extent both amongst the Europeans and natives. The Chinese are less liable to consumption than the Javanese and Africans (Lombard).

Hepatitis, both as an idiopathic disease and as a sequel of fever or of dysentery, finds one of its chief areas of prevalence in Java, where it is particularly common along the coasts. It is common at Batavia, Anger, Samarang, and above all at Sourabaya, where Europeans of all ranks and conditions are exceedingly liable to suffer from inflammation of the liver. The Javanese are affected to a much less extent.

Abscess of the Liver is seldom seen amongst the natives; but, although less frequent now than formerly, it is still one of the diseases most dreaded by European residents.

Beriberi is only occasionally seen at Batavia; at Sourabaya it is reported to show itself from time to time among the crews of ships in the port, and has been observed in the prisons of Batavia and Onrust. It was observed in an epidemic form at Passaroeang in 1841, where it appears to have been caused or aggravated by scarcity. Van Leent gives the number attacked on this occasion at 8000. It is reported to be endemic at Banjuwangi, but to what extent is not stated. It broke out at the Orphanage at Samarang in 1864 and 1865 (Hirsch).

Scrofulous Affections are said to be frequently observed amongst the children, but these disappear as the children grow up.

Rickets is a disease unknown amongst the natives, but is occasionally met with in children of European parentage.

Leprosy, according to Hirsch, is chiefly met with along the west coast and in the mountain districts, the disease being rare on the south and east coasts. It is not uncommon, however, at Batavia, on the north coast.

Syphilis is prevalent at Batavia, Sourabaya, and the seaports generally, but is much less widely diffused in the interior. It is very rare at Banjuwangi.

Goitre is endemic in the mountainous districts of the interior.

Frambœsia, which is endemic in Java, is frequently seen among the natives, Chinese, and Creoles at Batavia and Passaroeang; it does not affect Europeans.

Engorgement of the sub-maxillary glands, known as *Tagazen* or *Gondoo*, is a complaint mentioned in connection with Passaroeang, where Van Leent says it is common, and sometimes epidemic. Is it a variety of Mumps?

CHAPTER IX.

SUMBAWA GROUP.—CELEBES, SULU ISLANDS, MOLUCCAS, TENIMBER OR TIMOR LAUT ISLANDS, PHILIPPINE ISLANDS, NEW GUINEA.

Geographical and Climatological Notes.—The Sumbawa group comprises Lombok, Sumbawa, Sumba, Flores, and Timor. Lombok has an estimated area of 1480 square miles, and a population of about 200,000. The coasts are mountainous; the interior forms an extremely fertile valley.

Sumbawa has an area of 5838 square miles, with a population of about 100,000. It is mountainous, the volcanic peak of Tambora having an elevation of 9500 feet. The hills are covered with forests, but there are many fertile valleys, in which rice is largely cultivated. Sumba or Sandalwood Island is hilly in the interior, where it is covered with forests.

Flores has an area of 6026 square miles, with a population of 250,000. It is mountainous and heavily timbered. Timor has an area of 8820 square miles, with an estimated population of 400,000. It is traversed by a range of mountains extending throughout its entire length, some of the peaks rising to a height of 11,000 feet.

The dry season in these islands extends from May to November; from November to April heavy rains fall. The thermometer registers at Timor 25° C. in the morning, 35° at noon, and 30° in the evening, giving a mean of 27°·5 C. (Lombard). The east of the island of Timor belongs to the Portuguese, the west to Holland.

Celebes has been aptly compared to a star-fish, with the rays torn off from the west side. It is 800 miles long by 200 broad, and has an area of about 76,200 square miles, with a population of nearly a million. Its configuration consists of a central mountain mass, with ranges radiating through the four peninsular portions of which it is composed.

From this peculiar physical confirmation, it results that the island is destitute of large rivers or extensive plains, although considerable stretches of level land are met with along the coasts of the southern peninsula.

The Minahassa district, situated in the eastern peninsula, contains several active volcanoes, and is subject to earthquakes.

Macassar, on the west coast of the southern peninsula, is the capital, with a population of 25,000. Being situated on the equator, the temperature is high, rising to 32°·5 C., but the fresh sea-breezes modify the heat on the coasts, while at the higher elevations of the interior the climate is temperate and bracing. The dry season lasts from April to November; the rainy season from December to March.

The SULU ARCHIPELAGO is situated to the north of Celebes. The town of Sulu, the capital of the island of the same name, and of the group, is surrounded on the east and west by extensive marshes, formed by an admixture of salt and fresh water, which are left exposed when the tide is low, and exhale a fetid odour.

The MOLUCCAS may be taken to comprise the islands of Ternate, Tidore, Makian, Motir, Batjan, Gilolo, Ceram, Amboyna, and Buru, and many smaller islands scattered over the Banda Sea between Celebes and New Guinea. They are mostly of volcanic origin, with central mountain nuclei sloping down to the sea. They are generally very fertile and well wooded.

From their equatorial position the temperature of these islands is very high, often attaining 30° C. The east monsoon begins in May, and the west in December, and are accompanied with rain and storms.

The Tenimber Islands comprise Timor Laut and Larat, both of which are mountainous, and numerous smaller islands of coral formation. The area of Timor Laut is 3150 square miles, with a population of 15,000. The area of Larat is 147 square miles, with a population of about 3000. The climate is tropical and humid.

PATHOLOGY.—Malaria is the dominating element in the pathology of these islands. Sumbawa is very unhealthy along the coasts, and the disturbance of the soil appears to be followed by increased prevalence of the disease, for Van Leent informs us that the garrison suffered much from intermittent fever during the execution of some works in connection with the batteries of the fort. It was at Bima, in this island, that Letzer observed an epidemy of what Van Leent regards as malarial tetanus. The disease began suddenly, surprising the victim in the midst of his ordinary work, the first symptom being extreme debility. The patient rapidly passed into a soporose condition; then, all at once, an attack of tetanus set in, lasting about five to ten minutes, and recurring sometimes four or five times an hour. In favourable cases, the attacks diminished in number and violence, the patient falling into a sleep, during which profuse sweating occurred. Many died of this affection. Timor has a reputation for salubrity which it scarcely deserves. The eastern part, at least, is not free from malaria. Forbes, speaking of Dilly in this island, says: "We were above measure saddened to see the terribly emaciated countenances which proclaimed, more forcibly than words, the pestiferous nature of the climate."[1]

Celebes is, upon the whole, less subject to malaria than most of the neighbouring islands, although several localities along the east coast are far from healthy. The province of Macassar, and the town of the same name, are comparatively free from fever, except of the milder forms, which are chiefly met with at the change of the monsoons.

In the Sulu Archipelago, intermittent, bilious remittent, and pernicious fevers of the comatose and syncopal forms are prevalent (Sollaud).

Ternate, in the Molucca group, is only moderately affected. Amboyna, which was formerly esteemed healthy, has suffered considerably from fever, since an earthquake that occurred there in 1835. The quotidian type is that which is generally seen. Pernicious attacks are rare.

Bura, situated to the west of Amboyna, is much more unhealthy. The town is situated on a low marshy plain, and is inundated during the rains. Forbes states that the population suffers from malarial fever, rheumatism, and, curiously enough, from sterility.[2]

The Tenimber Islands are notoriously malarious. The fever is of great severity, rising to 103°–105° F., with sickness, sometimes accompanied by strong delirium, lasting with intermissions for about three weeks.

Typhoid Fever has not been described as occurring in these islands, and we may therefore conclude that it is rare, although it is not unlikely that it exists unrecognised, being confounded with the typhoid forms of malarial fever. *Typhus* has been observed in the Celebes.

Dysentery is somewhat prevalent on the coasts of Celebes, but the province of Macassar is only slightly affected. Although none of the islands can claim an immunity from this disease, Ternate, Amboyna, and Timor suffer only to a small extent, the first two being notably free from the disease.

Asiatic Cholera.—The only epidemics of cholera recorded by Hirsch as having affected the groups with which we are dealing, are those of 1820 in the Moluccas, and of 1858 in Celebes and Banda; but it is probable that other outbreaks of the disease besides those here mentioned have occurred. Amboyna has enjoyed a remarkable immunity from cholera.

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[1] Forbes, *A Naturalist's Wanderings in the Eastern Archipelago*, Lond., p. 415.

[2] Forbes, *Op. cit.*

Smallpox committed great ravages in these islands during the first half of this century, but of late years its epidemic diffusion has been greatly restricted by the increasing attention paid to vaccination. *Measles* prevails occasionally throughout the whole of these groups, but the disease is of a mild type. *Scarlet Fever* is unknown.

Respiratory Diseases are by no means fatal in these islands. Information as to the prevalence of *Phthisis* is scanty. It is stated, however, to be of frequent occurrence in Amboyna.

Hepatitis is less prevalent in the Moluccas and Celebes than in many parts of the Archipelago; and, as elsewhere, it is much more frequently seen among the European residents than among the native population.

Leprosy is met with in Banda and Flores, in the interior of Timor, in the province of Minahassa in Celebes, and to some extent in the Moluccas. The lepers numbered only twenty some years ago in Ternate. The natives of Ternate believe that frambœsia and leprosy are mutually exclusive, and they inoculate themselves with the secretions of frambœsia in order to obtain immunity from leprosy. Whether the disease described by v. Meerdervoort under the name of *Cascadæ*, as prevalent in the islands of Ceram and Arru, is true leprosy or ichthyosis, is uncertain.

Syphilis is rare in Timor, but is more prevalent in the Molucca group, and in the ports and more populous districts of Celebes. It is stated by Lombard that syphilis was unknown in the district of Gorontalo until quite recently, when it was introduced by a European.

Frambœsia is widely diffused throughout these various groups of islands, particularly in the Moluccas, where the *bouton d'Amboine* is truly endemic.

Beriberi is endemic in Macassar and in the Molucca group.

THE PHILIPPINE ISLANDS.

GEOGRAPHY.—The Philippine Islands stretch from 5° 30′ to 19° 42′ N. lat., and from 117° 14′ to 126° 4′ E. long. Their entire area is estimated at 94,490 square miles, with a population of about 6,500,000. The two most important islands of the group are Luzon in the north and Mindanao in the south. Manilla, the capital, is situated on the south-west coast of Luzon, and has about 250,000 inhabitants. Samboanga is the principal town of Mindanao. Cebu has 10,000 inhabitants.

CLIMATOLOGY.—The climate of the Philippines is tropical and insular. The year is usually divided into three seasons—the cold, the hot, and the wet. The cold season extends from November till February; the hot season, from March to June; the wet season, from July to October. The following are the average temperature F. and the rainfall in inches, from Manilla in the north to Sulu in the south:[1]—

		Seasons.		
		Cold.	Hot.	Wet.
Manilla,	Mean Temperature,	72·32	87·26	84·56
	Rainfall,	8·65	10·47	36·01
Cebu,	Mean Temperature,	75·02	86·23	75·86
	Rainfall,	12·54	9·29	26·90
Davao,	Mean Temperature,	86·90	88·70	87·10
	Rainfall,	16·53	39·27	32·15
Sulu,	Mean Temperature,	81·98	82·97	83·03
	Rainfall,	15·74	33·85	35·43

PATHOLOGY.—*Malarial Fever* is more or less common along the level coast tracts of all the islands. Sollaud mentions the province of Balabac, near to Manilla, as being specially liable to malarial diseases. The quotidian type is that which is most frequently observed, and tends rapidly to induce cachexia. The various forms of pernicious fever are occasionally observed among the Europeans, but the syncopal and comatose forms are those met with amongst the natives. Remittent fever may either precede or follow an attack of intermittent. At the beginning of the rainy season, malarial fever may assume an adynamic character, which makes it resemble typhoid or typhus. The marshy environs of Manilla, and of Samboanga in the south, with its excessively high temperature, are nevertheless comparatively free from the graver forms of fever.[2]

Diarrhœa and *Dysentery* are by no means absent from the pathology of these islands, but dysentery is said to be neither so frequent, nor of so severe a character, as in Java and some of the other islands. This at least is true of Manilla and its neighbourhood, but our knowledge of the diseases prevailing in the various parts of this group is very imperfect.

Asiatic Cholera.—The Philippines were visited by cholera in 1820, and again in 1858; but I am unable to say whether these are the only occasions on which cholera has invaded the group, or to what extent, and with what intensity, it prevailed when it was introduced.

Smallpox and *Measles* are often epidemic; the former makes many victims, but the latter is mild. No mention is made of *Scarlet Fever* in the Philippine group.

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[1] *Ency. Brit.* art. "Philippines."

[2] *Archiv. de méd. nav.* vol. xxxviii. p. 261.

Bronchitis is of rather frequent occurrence in the Philippines.

Phthisis is more common in the Philippines than in the Eastern Archipelago generally, and is specially frequent among the *Tagals* who inhabit the north of Luzon. Sollaud mentions that in the Military Hospital at Manilla, in a ward containing 60 patients, he found 45 natives who were suffering either from chronic bronchitis or phthisis. Pneumonia, pleurisy, influenza, and whooping-cough are comparatively rare.

Hepatitis is by no means rare in the Philippine group generally; its headquarters appear to be in Luzon, where it is somewhat frequent amongst the European part of the population.

Anæmia and *Chlorosis* are common both among the Europeans and natives.

Leprosy is endemic in many parts of this group. The leper house at Manilla contains 200 inmates, and this is not the only lazaretto in the Philippines.

Elephantiasis is met with to a considerable extent throughout the group.

Syphilis exercises its ravages both amongst the natives and the Spanish troops. Sollaud found 43 out of 201 patients in the Military Hospitals were suffering from venereal affections.

NEW GUINEA.

GEOGRAPHY AND CLIMATE.—New Guinea, to the north of Australia, lies between 0° 30′ and 10° 40′ S. lat., and between 131° and 150° 30′ E. long. Its length is about 1300 miles, and it varies in breadth from 35 to 360 miles. The greater part of the interior is unexplored, and even the coasts are imperfectly known. The interior is mountainous; some of the ranges, as that which reaches the south coast near Geelvink Bay, are of great height. The range which we have just mentioned rises in some places to an elevation of above 16,000 feet.

In that part of the island which is now under British protection, a ridge extends from east to west, attaining in Mount Owen Stanley a height of 13,206 feet. Between these ranges and the sea immense plains extend. In many districts, comprising the coast plains, the country is low and marshy, in others it is more raised and undulating. The climate is hot, humid, and relaxing.

The parts with which we are acquainted are undoubtedly malarious. Lawes informs us that 95 out of 201 South-Sea Islanders, placed at Port Moresby since 1872, had died. All of these were picked men, in the prime of life. Of five ladies who have attempted to live in British New Guinea, two died, and a third, when he wrote, was leaving on account of fever. Of the diggers that visited the country in 1877, some died, and all were so stricken with fever that they were glad to get away with their lives. It is the exception for a white man to be a few weeks in New Guinea without taking fever. Inland and on the coast, and on the smaller outlying islands, fever is met with everywhere. Port Moresby is perhaps as healthy as any part we know.[1] The country round Port Moresby is comparatively dry and barren.

Finschhafen, in the German territory, has had to be abandoned, after the loss from fever, in February 1891, of several officials and seamen of the Imperial service. The station has been transferred to Alexishafen.

The remittent and intermittent forms of *Fever* are alike met with in New Guinea. The remittent in many cases is distinguished more by the debility it induces than by the violence of the symptoms. It commences with rigors; the temperature in the morning may be 100°, in the evening 102° or 103°. There is loss of appetite, and gradual loss of strength, which may lead to a fatal termination.

In the intermittent form, the cold stage is not well marked; the hot stage is prolonged and severe. When at length the sweating stage sets in, it brings little relief; and long before the usual time the fever returns, and then it is the same thing over again. In these cases bilious vomiting is often very severe, the spleen in children is often enlarged. Lawes, whose description we have followed, says that he has observed dogs to have shivering fits followed by a hot stage. No sweating stage was noticed. The attacks lasted for a few hours, and used to return at regular intervals. *Dysentery* is also endemic in the island, but is rare. *Beriberi* is endemic on the west coast. "*Elephantiasis,* sporadic amongst the natives, has not been known to affect the Europeans. *Leprosy* is not an uncommon native disease, but it does not present its worst form, and has not been communicated to any white person. The only contagious skin disease of any consequence from which the natives suffer, is the most loathsome form of *Ringworm*. *Itch* has not been introduced." New Guinea is the only country I have heard of to which the *Acarus Scabei* is a stranger (*Brit. N. Guinea Report,* 1888–89). I have not met with any reliable information respecting the Admiralty Islands, New Britain, New Ireland, or the Solomon Islands to the north-east of New Guinea. Farther north are the Caroline Islands, with a hot and moist climate, tempered by cooling breezes, where malaria of a mild type is endemic.

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[1] *Aust. Med. Gaz.*, May 15, 1887.

CHAPTER X.

AUSTRALIA.

GEOGRAPHY.—The island of Australia, a continent in itself, lies between 10° 39′ and 39° 11′ S. lat., and between 113° 5′ and 153° 16′ E. long. From Cape York in Queensland to Cape Wilson in Victoria, the distance is 1971 miles; from Cape Byron in New South Wales to Steep Point in Western Australia, it is 2600 miles. The area is about 2,900,000 square miles.

Mountain ranges skirt the coast on the east and west at varying distances, but never more than 100 miles from the sea—often less. The most important chain follows the line of the eastern coast, about 60 to 70 miles inland. This is known in the north as the Blue Mountain range, in the south as the Australian Alps, and a continuation westward through Victoria of the same range is known as the Great Dividing Range. The Blue Mountains do not rise above 3500 feet. Mount Kosciusko rises to 7300 feet above the sea-level, and is covered with snow for the greater part of the year. To the north, the Blue Mountains are continued in broken ridges through Queensland north to 18° S. lat. On the western side of the island the mountains in the north are in detached ranges running from east to west, while to the south they run more or less parallel to the coast.

The interior is a level plain, consisting mainly of dry, sandy steppes, presenting in some parts ranges of hills of low elevation. As we approach the north-east coast, the country becomes more diversified and fertile, watered with streams, and, in many parts, well wooded. The hilly coast ranges, and the country between the hills and the sea, consist of fertile grassy tracts diversified with brush or scattered forest.

From the arrangement of the mountains, it follows that the rivers on the east coast are comparatively short.

The Murray, which, after a course of 2345 miles, falls into the sea at Encounter Bay, in South Australia, is the largest river of the country. It admits of internal navigation for 1800 miles. It rises on the western slope of the Australian Alps and their northern continuations, receiving numerous tributaries, the most important of which are the Murrumbidgee and the Darling. The east coast is well watered by numerous small rivers descending from the eastern slope of the mountains. Many of these are liable to overflow. The Hawksbury, near Windsor, has been known when in flood to rise 80 feet above its general level. Since the settlement of the Colony, some sixty or more visitations of this kind have taken place, causing extensive flooding of the country through which it flows, with general destruction to property and life. These inundations occur at all seasons, but most frequently in autumn. On the other hand, periods of drought are frequent, when even rivers such as the Darling become a series of disconnected pools. The Swan river is the most important in Western Australia. Many of the rivers on the west coast dry up in summer. More important are the rivers which enter the Gulf of Carpentaria. The Mitchell, the Flinders, and the Gilbert are no winter torrents, but wide rivers rising in the high lands of Queensland, running through, and often inundating, the level plains that border the gulf. On the south coast no stream enters the great Australian Bight for a stretch of 500 miles. Another system of rivers yet imperfectly known are those that do not find their way to the sea, but end in inland lakes. Thus, the Macumba, Barcoo, Neale, and Warburton end in Lake Eyre.

South Australia is covered with numerous brackish lakes. Lake Torrens is 130 miles long by 20 to 30 broad. It is at certain seasons reduced to the condition of a salt swamp. Lake Amadeus, between 24° and 25° S. lat., in the centre of the island, is another large lake of the same kind. Small brackish lakes abound in the interior of Western Australia.

The shores of the Gulf of Carpentaria are eminently marshy. Much mangrove swamp is found near the mouths of the rivers. Swampy stretches are met with here and there in Queensland. In the interior of New South Wales, marshes are met with in the vast clayey basin through which the numerous tributaries of the Darling rise and flow.

CLIMATOLOGY.—The climate of the southern parts of Australia is temperate, that of the north tropical. The rainfall on the east coast is greater than that on the west. On the east the rainfall is heaviest near the coasts, diminishing as we pass inland. On the north coast the period of heavy rains extends from December to March; on the east coast, down to the 29th degree, it is somewhat retarded, the maximum falling in the four months, January to April. Along the coast of New South Wales the rainy season extends from February to May or June; while along the south coasts of Victoria and South Australia, the period of maximum rainfall is not uniform, but, as a rule, extends from May to September. The interior is characterised by high temperature, low rainfall, and great dryness of the atmosphere. In all parts of the country the rainfall is subject to great fluctuation, so that droughts and floods alternately menace the farmer.

The following table gives the principal meteorological elements at the six capitals of Australia:—

METEOROLOGY OF SIX STATIONS IN AUSTRALIA.

Months.	ADELAIDE.			MELBOURNE.			SYDNEY.		
	Mean Temp. 1865–74.	Mean Daily Range.	Average Rainfall 1839–74.	Mean Temp.	Mean Daily Range.	Average Rain-fall.	Mean Temp. 1856–88.	Mean Daily Range 1887.	Average Rainfall 1864-86.
January, . .	73·7	25·4	0·722	66·5	24·6	2·09	71·4	11·5	3·523
February, . .	73·8	24·9	0·670	65·5	21·4	1·90	70·9	11·8	5·568
March, . .	70·1	23·3	0·881	63·7	22·8	1·83	69·2	10·7	4·755
April, . . .	64·6	19·7	1·760	58·8	19·1	2·08	64·6	9·5	6·517
May, . . .	58·2	16·1	2·814	53·3	15·7	2·09	58·2	11·1	4·973
June, . . .	54·4	14·0	2·915	49·8	12·2	2·00	54·0	9·8	5·472
July, . . .	51·5	14·7	2·801	47·6	16·4	1·97	52·3	11·8	4·276
August, . .	53·7	17·1	2·621	49·9	15·1	1·88	54·8	10·7	2·818
September, .	56·9	19·1	2·071	53·1	18·1	2·45	58·5	13·9	3·066
October, . .	62·5	22·9	1·739	57·3	17·4	3·12	63·1	14·3	3·126
November, .	66·5	24·4	1·203	60·7	19·2	2·23	66·2	12·8	3·123
December, .	71·4	25·1	0·894	63·8	19·8	2·57	69·6	11·8	2·263
Totals and Means, .	63·1	20·6	21·091	57·5	18·5	25·81	62·7	11·6	49·489

Months.	BRISBANE.			PERTH.		PORT DARWIN.	
	Mean Temp. 1887.	Mean Daily Range 1887.	Average Rain-fall 17 Years	Mean Temp. 18 Years.	Average Rainfall 13 Years.	Mean Temp. 1882.	Annual Rainfall 12 Years.
January, . .	76·6	15·0	6·57	75·0	0·46	86·0	15·063
February, . .	74·2	13·3	7·91	76·0	0·45	84·4	11·838
March, . .	74·3	12·6	7·71	72·0	0·76	85·0	12·029
April, . . .	69·0	14·5	5·12	66·0	2·12	86·1	4·502
May, . . .	61·0	18·0	2·80	60·0	4·88	81·7	0·891
June, . . .	56·3	17·3	4·17	56·0	6·19	75·8	0·023
July, . . .	57·5	18·9	2·91	55·0	5·81	77·2	0·007
August, . .	59·3	18·4	2·71	56·0	5·85	79·4	0·254
September, .	63·2	19·9	1·69	59·0	2·58	84·4	0·217
October, . .	68·5	21·3	2·71	63·0	1·53	86·5	2·658
November, .	69·7	18·8	3·34	69·0	1·11	86·3	3·873
December, .	72·3	16·0	4·65	71·0	0·72	84·7	11·167
Totals and Means, .	66·8	17·0	52·29	65·0	32·46	83·1	62·522

VITAL STATISTICS.—Australia is divided into five Colonies, viz. New South Wales, Victoria, South Australia, Queensland, and Western Australia.

The following table gives the population (1855), and the marriage, birth, and death rates of each Colony:—

Colony.	Population 1885.	Marriage-rate 1865–67.	Birth-rate 1865–87.	Death-rate.	Deaths of Infants under one Year, per 100 Births, 1866–86.
New South Wales,	957,914	16·10	39·04	15·62	11·45
Victoria, . . .	991,869	13·62	34·61	15·57	12·35
South Australia, .	313,423	15·94	38·50	14·84	14·41
Queensland, . .	315,489	17·30	39·65	17·92	13·15
Western Australia,	35,186	13·98	33·89	16·37 [1]	...
Total and Means,	2,613,881	15·39	37·16	16·06	12·84

In all the Australian Colonies the warm season is that of the highest mortality. In Queensland the fourth quarter is generally that in which most deaths occur; but in New South Wales and the southern Colonies, the first quarter is the most fatal. The following are the quarterly percentages of deaths in New South Wales and Victoria:—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
New South Wales, .	26·58	25·20	22·39	25·83
Victoria, . . .	29·55	25·72	21·07	22·66

PATHOLOGY.—*Malaria.*—Malarious diseases occupy a very insignificant place in the pathology of the Australian continent, although there are not wanting conditions that might appear favourable for their development. The overflow of rivers, the opposite condition of drought by which lakes are converted into swamps, the breaking up of virgin soil, and the high range of temperature, are conditions that are found to be closely associated with malaria in other countries; but although these are all to be met with in Australia, the continent enjoys a remarkable immunity from this class of diseases.

Graves quotes Bynoes' experience of six years' exploration of the northern shores of Australia, which illustrates forcibly the freedom from malaria which it enjoys. "On the north and north-west coasts, where you will find every bight and indentation of land fringed with mangroves, bordering mud-flats, and ledges formed by corallines in every stage of decomposition, with a high temperature, no fevers or dysenteries were engendered. The ship's company was exposed to vicissitudes from wet to dry weather, sleeping in mangrove creeks for many months in succession, and pestered by mosquitoes during the hours of repose. Yet they still remained very healthy."[1]

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[1] 1872-88.

This is not the history of exploration in a malarious country. It must not, however, be supposed that malaria is entirely absent from the swampy regions of the north. We know that this is not the case. Some stations along the shores of the Gulf of Carpentaria have had to be abandoned on account of their unhealthiness; but still there is a remarkable and unexplained contrast, as respects the prevalence of malaria, between the northern shores of Australia and the neighbouring coasts of New Guinea.

Fevers, too, of a mild character are occasionally observed in northern Queensland to follow the clearing and breaking up of the virgin soil.

The death-rate from ague in the southern Colonies of New South Wales, Victoria, and South Australia is so small, that we are justified in suspecting that the few deaths, from this cause, occurring in these Colonies are of persons who have contracted the disease elsewhere. Years pass without a single death being registered from ague in South Australia. The average death-rate from ague in New South Wales, for the ten years ending 1887, was 0·49, and in Victoria it was 0·41 per 100,000. In Queensland the ratio for 1887–88 was more than double this, viz. 1·07 per 100,000, while in 1886 the ratio was 12·3.

Remittent Fever is also a rare disease in the southern Colonies, but is of more frequent occurrence in Queensland and Western Australia. The average death-rate from this disease in Victoria was 0·84; in South Australia, 3·5; and in New South Wales, 2·27, for the ten years ending 1887. In Queensland the ratio for the six years ending 1888 was 20·40. In Western Australia the death-rate in 1888 was 11·6 per 100,000. What is the nature of the remittent fever met with in the southern Colonies where ague is unknown? Can we suppose that the severer manifestations of the malarious infection occur where the milder intermittent forms are absent? To me it seems doubtful whether malarial remittent fever forms any part of the pathology of South Australia, Victoria, or New South Wales, and it is improbable that the comparatively large proportion of deaths from remittent fever registered in Queensland should be due to malaria. This is a point, however, which demands further investigation. It is to be observed that the ratio of deaths from remittent fever in

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[1] Graves, *Clinical Medicine*, Lecture xxv.

Queensland varies greatly in different years, and that it rises and falls, to a certain extent, as typhoid fever is more or less prevalent. This will be evident from the following figures, which give the death-rates of the two diseases for the period 1883–88 :—

DEATH-RATE IN QUEENSLAND PER 10,000 OF THE MEAN POPULATION, FROM TYPHOID AND REMITTENT FEVERS, FROM 1883 TO 1888.

	Typhoid Fever.	Remittent Fever.
1883,	8·89	3·36
1884,	18·15	5·02
1885,	6·19	0·91
1886,	9·14	0·90
1887,	3·86	0·59
1888,	4·32	1·48

Are we to conclude from this that deaths from mild cases of typhoid are returned as remittent fever, or that the remittent fever is mainly malarious—the malarial and typhoid processes being influenced by similar conditions ? I incline to the former view.

Typhoid Fever.—This is, *par excellence*, *the* fever of Australia. The following are the deaths per 10,000 of the population for the sixteen years ending 1888, in the case of Victoria, Queensland, and South Australia; in the case of New South Wales, the figures refer to the period of fourteen years ending 1888 :—

New South Wales,	5·08	South Australia,	4·09
Victoria,	5·28	Queensland,	7·90

Typhoid fever is twice as fatal in South Australia, and nearly four times as fatal in Queensland, as in England. Are we to take the proportions of the death-rates of the different Colonies, compared with each other and with England, as a measure of the sanitary condition of the respective countries ? It is difficult to suppose that the enteric death-rate is here to be regarded as a measure of the sanitary conditions under which these widely varying rates obtain. Indeed, this doctrine, which is generally true as regards towns, especially in temperate regions, in which the disease is largely disseminated by infection from previous cases, does not hold true as regards countries in the warmer temperate and tropical regions in which the disease is mainly miasmatic.

No very close correspondence is to be traced, as a rule, between the annual fluctuations of the enteric fever death-rates in the several Colonies, nor is there any periodicity to be observed in the annual rise and fall of the death-rates in the individual Colonies. A year or two of comparatively high death-rates are followed by a low death-rate for one or two years in succession, but the periods of rise and fall are very irregular. The range of fluctuation in different years is greater in Queensland than in the southern Colonies. Thus, in recent years, the highest death-rate from enteric fever in Queensland reached 18·15 per 10,000 of the population in the year 1884, and fell as low as 2·03 in 1880. In Victoria, it reached 6·58 in 1877, and the lowest was 3·49 in 1880,—a year when enteric fever was at its minimum in all the Australian Colonies, and we may remark that this also was a year of low fever and cholera mortality in India.

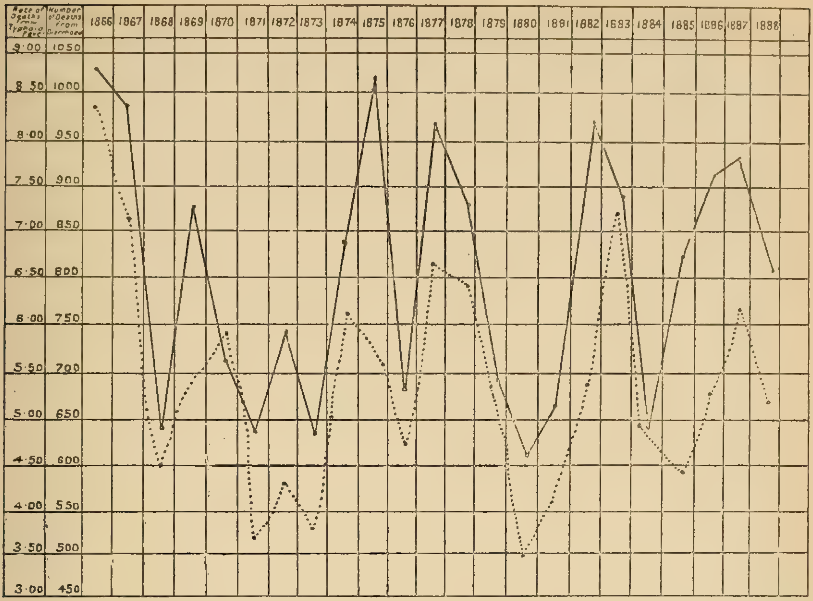
Typhoid fever attains its maximum in the autumn months of March, April, and May in South Australia, Victoria, and New South Wales; and its minimum in September, October, and November, the rise commencing in December. In Queensland the maximum seems to fall upon the hot season, from November to February.

We have endeavoured to show, as regards some other countries, that a high summer temperature tends to determine an increase in typhoid fever in the autumn months. I have not been able to obtain, for all of the Australian Colonies, the mean summer temperature for an adequate series of years, with the corresponding death-rates from enteric fever during the autumn of the same years. But we have the means of judging indirectly the influence of summer temperature on the prevalence of typhoid fever in Victoria, and directly in New South Wales.

Diarrhœa is a disease the prevalence of which is closely related to summer temperature. The number of deaths from diarrhœa rises in warm and falls in cold seasons. We may thus accept the diarrhœa death-rate as an index of the temperature of the summer season. Now, in respect to Victoria, we have the number of deaths registered from diarrhœa in each year from 1866 to 1888, and also the death-rates for the same years from enteric fever, per 10,000 living. If, therefore, a high summer temperature increases the typhoid death-rate, we should expect to find a certain correspondence between the annual fluctuations in the mortality from these two diseases. I have thrown into the form of a diagram the actual number of deaths registered from diarrhœa, and the ratio of typhoid fever deaths per 10,000 of the population, for the twenty-three years 1866–88, a period sufficiently long to enable us to trace the relation, if any, between the variations of summer temperature (as manifested by the fluctuations in the deaths from diarrhœa) and the annual mortality from typhoid fever.

ANNUAL FLUCTUATIONS OF TYPHOID FEVER AND DIARRHŒA, VICTORIA.

Diarrhœa, ———. Typhoid, ········ .



It will be seen, from the above diagram, that, as a rule, the mortality from typhoid fever and diarrhœa rise and fall together; and the inference I draw from this is, that the higher or lower summer temperature, which increases or diminishes the deaths from diarrhœa, has a similar influence on the prevalence of typhoid fever in Victoria.

The relation between the fatality of typhoid fever and high summer temperature is very evident in New South Wales. The mean death-rate from typhoid fever in this Colony, from 1877 to 1887, was 5·02 per 10,000 living; the mean temperature of the three summer months, December, January, and February, at Sydney was 71°·14 F. Now, if we arrange the years according as the means of summer temperature and the deaths from typhoid fever were respectively above or below the mean of the eleven years, we shall have the following relations between them:—

YEARS IN WHICH THE MEAN SUMMER TEMPERATURE AND TYPHOID FEVER DEATH-RATES WERE ABOVE THE MEAN.

		1877.	1878.	1882.	1884.	1885.	1886.
(Mean Temperature, . .	71·14 F.)	71·40	72·0	71·17	71·47	71·87	72·10
(Mean Typhoid Death-rate, .	5·02)	5·96	6·70	5·66	5·86	5·40	6·03

YEARS IN WHICH THE MEAN SUMMER TEMPERATURE AND TYPHOID FEVER DEATH-RATES WERE BELOW THE MEAN.

		1879.	1880.	1881.	1883.	1887.
(Mean Temperature, . .	71·14 F.)	71·0	70·17	70·03	70·07	71·10
(Mean Typhoid Death-rate, .	5·02)	3·84	3·31	3·50	4·76	4·24

It will thus be seen that, in New South Wales, the years in which the summer temperature is above the mean are years when the typhoid fever death-rate is above the mean, and *vice versa.* It will also be observed that the two years 1878 and 1886, when the temperature was highest, the typhoid mortality was greatest.

Typhoid fever in Northern Australia is often with difficulty distinguished from malarial fever; and even in such cases as are truly typical, the disease occurs under circumstances that renders it in the highest degree improbable that it has been derived from a previous case. Hunt, for example, stating his experience of the etiology of such typical cases in North Queensland, says, "they occurred in remote stations, far removed from the routes of traffic, where no typhoid was ever known" (*Aust. Med. Gaz.*, Dec. 1890). These are almost the same terms in which Crawford describes the occurrence of the disease in Afghanistan, and Hoff in the United States.

Typhus Fever is not endemic in Australia.

Relapsing Fever does not appear to be met with in any of the Australian Colonies.

Cerebro-spinal Fever is occasionally observed. We find 8 deaths ascribed to this disease in New South Wales in 1886, and 6 deaths in 1887; one death from this fever is recorded in Queensland in 1888. Whether this refers to the true epidemic malady is, however, doubtful.

Influenza.—Australia has been visited by epidemics of this disease in 1827, 1836–38, 1852, 1860, and again in 1890.

Whooping-Cough is much less fatal in Australia than in England. In the former, the average death-rate for all the Colonies in recent years has been about 19 per 100,000, while in England the average is about 50 per 100,000.

Erysipelas is by no means of frequent occurrence in Australia, the average death-rate being 42·8 per million in South Australia, and 45·3 per million in New South Wales.

Diphtheria and *Croup* play a very important *rôle* in the pathology of the southern continent and of the neighbouring islands. As the two diseases are always more or less confounded, we shall give the death-rates per 100,000 for both in a single table; but it must be borne in mind that the fatality of these diseases varies greatly in different series of years:—

		Diphtheria.	Croup.
South Australia, ...	1878–87 [1]	26·95	25·39
Victoria, ...	1881–85	14·93 [1]	17·42
New South Wales, ...	1877–86	25·37	23·58
Queensland, ...	1883–88	22·40	29·60

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[1] These ratios are very much under those for 1871-80.

In order to estimate the meaning of these figures, it may be as well to note that the average death-rate from diphtheria in England from 1881–84 was 15·40, and from croup 16·4. From this it will be seen that both diseases are more fatal in Australia than in England. Diphtheria was nearly three times as fatal in Victoria during the decade 1864–73 as in the period given above. As a rule, three years of heavy mortality succeed each other, to be followed by two or three years of a diminished death-rate. The disease does not appear to be affected by the temperature or rainfall. The months of maximum mortality of croup and diphtheria combined are April, May, and June, and sometimes July, and these appear to be the months of maximum prevalence of diphtheria alone. Diphtheria first assumed an epidemic form in Australia in the year 1858, that is, about the same time as the disease assumed epidemic proportions in England.

Diarrhœal Diseases.—In order to give a view of the whole of this class of diseases, we shall combine them in a single table, showing the deaths per 10,000 living in the different Colonies:—

		Dysentery.	Diarrhœa.	Enteritis.	Cholera Nostras.
South Australia, .	1878–87	12·30		2·19	0·64
Victoria, . . .	1881–85	1·37	8·75	2·20	...
New South Wales, .	1877–86	1·97	8·21	4·10	0·92
Queensland, . .	1883–88	11·58	11·43	3·9[1]	0·93
Western Australia, .	1888	4·47	10·35	3·29	...

It will be seen that all these diseases, especially dysentery, increase in frequency as we approach the warmer regions of the north. Dysentery, which causes an average death-rate of 1·37 per 10,000 in Victoria, gives rise to 4·47 deaths in Western Australia and to 11·58 in Queensland. A distinct but smaller increase is likewise observed in the death-rates from diarrhœa, enteritis, and cholera in the lower latitudes. The death-rate of South Australia from the whole of these diseases is 15·13; that of Queensland, 27·87; while that of England (1871–80) is 9·35. It thus appears that diarrhœal diseases are very considerably more fatal even in the coldest districts of Australia than in England. That the dysentery of Queensland is not simply inflammatory diarrhœa in children, but of the more severe form met with in warm climates, is shown by the fact that 80 per cent. of the deaths occurs in persons over five years of age.

This class of disease is specially prevalent in the warm season. The marked rise in the diarrhœal death-rate commences in October in Queensland, and in November in New South Wales and Victoria. Australia has hitherto escaped visitations of *Cholera.*

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[1] For the year 1888 only.

The class of *Eruptive Fevers* is believed not to have been originally endemic in Australia, but to have been introduced into this continent since its colonisation.

Smallpox first made its appearance among the European population towards the end of 1838; scarlet fever, in 1848; and measles as late as 1854 (Hirsch).

Smallpox has never spread to any great extent among the European colonists. From 1853 to 1889 the deaths recorded from the disease in Victoria numbered 26; and in New South Wales we find only 49 deaths from smallpox during the ten years ending 1886. This immunity is chiefly owing to the protection afforded by vaccination; but it is also, in part, due to the careful measures of inspection and isolation adopted by the authorities. That the climate has nothing to do with this result, is shown by the fact that smallpox has not spared the unprotected aborigines, among whom it has often raged in an epidemic form, carrying off, according to some estimates, from one-third to one-half of the affected tribes.

Scarlet Fever must now be regarded as naturalised in Australia, as no year passes in which it does not cause a greater or lesser mortality. Taking a series of years, however, it will be found to be much less destructive in Australia than in England. The following are the death-rates from scarlet fever per 100,000 of the population in the principal Colonies:—

VICTORIA.		SOUTH AUSTRALIA.	NEW SOUTH WALES.	QUEENSLAND.
1871–80.	1881–85.	1878–87.	1877–86.	1883–88.
51·46	6·18	12·50	9·43	1·3

The scarlet fever death-rate of England (1871–80) is 71·6 per 100,000. If scarlet fever is thus, as a rule, much less fatal in Australia than in England, yet one destructive epidemy of the disease has been observed in Victoria, viz. that of 1876, when 2240 deaths were registered from scarlet fever, which gives a ratio of about 270 per 100,000. Scarlet fever seems to decrease in fatality towards the north.

Measles.—The following table shows the mortality from measles in the different Colonies per 100,000 living:—

VICTORIA.		SOUTH AUSTRALIA.	NEW SOUTH WALES.	QUEENSLAND.
1871–80.	1881–85.	1878–87.	1877–86.	1883–88.
26·10	8·47	8·88	5·96	4·30

The average death-rate from measles in England (1871–80) is 37·8 per 100,000, from which it appears that this disease is much less fatal in Australia than in England. Indeed, measles is doubtfully endemic in the southern continent. During the three years 1877–79 the average number of deaths ascribed to measles in

New South Wales was two a year; in Victoria, during the four years 1876–79, the deaths numbered 19 in all. These, for anything we know to the contrary, may have been cases imported from without. In the year 1873, one death only was caused by measles in Victoria. There are years, again, when measles is more or less widely epidemic in the Australian Colonies. Such a year was 1875, when this disease caused 1541 deaths in Victoria. It is, at least, open to doubt whether these outbreaks, recurring after the disease has been almost entirely absent from the Colonies for periods of three and four years, are not due to fresh reintroductions of the poison from without, rather than to a lighting up of the smouldering embers of infection remaining in the country.

Respiratory Diseases.—Diseases of the respiratory organs are less fatal in Australia than in England. In Victoria we find the average mortality from this class of affections to have been 21·84 per 10,000 for the years 1881–85, as compared with the English average of 34·91 for the period 1881–84.

Bronchitis.—The low death-rate in Australia from bronchitis is the point in which the pathology of Australia differs most widely from that of England. In South Australia and Victoria, the average death-rate from bronchitis for the period 1878–87 was 6·88 and 6·60 respectively; in New South Wales (1877–86) it was 7·3; and in Queensland (1883–88), 4·35 per 10,000; while the English average is about 19·5 per 10,000. This difference is not owing to equability of temperature, for the range is higher in the south of Australia than in England. The combined dryness and warmth of the atmosphere of Australia, the lesser development of manufacturing industries, and the larger proportion of the population engaged in agriculture, are all conditions conducing to a low bronchitic mortality in Australia. That the purity of the air, and the industries and mode of life of the population, count for more than temperature in the causation of bronchitis, is shown by the relatively greater prevalence of the disease in the urban as compared with the country districts of Australia.

Pneumonia is less fatal in Australia, as a whole, than in England; but the difference between the death-rates in the two countries is less marked than in the case of bronchitis. Indeed, there are English counties where pneumonia is less fatal than in any Australian Colony. The distribution of the disease in Australia is not solely, if at all, determined by latitude, as will be seen by the following figures, giving the death-rates per 100,000:—

SOUTH AUSTRALIA. 1878–87.	VICTORIA. 1878–87.	NEW SOUTH WALES. 1877–86.	QUEENSLAND. 1883–88.
60·7	76·9	70·6	69·5

In South Australia the death-rate from pneumonia is lower than in Queensland, which is situated so much farther north, and where the climate is warmer and also more equable. Pneumonia is specially fatal among the Polynesians of Queensland, who, however, numbered only 8667 in 1888. The higher death-rate of Victoria is not entirely to be ascribed to climate, but is no doubt partly owing to the less healthy conditions of life in which a considerable part of the population are placed. Pneumonia and bronchitis are most fatal in the cold season, from May to September.

Pleurisy causes an average death-rate of 4·9 per 100,000 in South Australia, of 6·8 in New South Wales, and of 5·7 in Queensland. Pleurisy is thus as fatal in Australia as in England. It does not appear to be less prevalent in the warmer than in the colder districts.

Congestion of the Lungs appears in the returns of some of the Colonies as a death-cause. In New South Wales the average death-rate from congestion of the lungs is 17·7, and in Victoria 19·0 per 100,000.

Phthisis, although it gives rise to a smaller mortality in Australia than in England, nevertheless usually takes the first place among the causes of death in the Australian Colonies, and of late years the mortality from consumption has been augmenting to a marked extent. During the ten years ending 1880 the death-rate from consumption in Victoria was 127·4, while in 1881–85 it had risen to 140·8, per 100,000, and this increase is said to fall largely on born Victorians.[1]

The following are the death-rates from phthisis per 100,000 of the population in the individual Colonies and in England:—

VICTORIA. 1875–86.	SOUTH AUSTRALIA. 1873–86.	NEW SOUTH WALES. 1873–86.	QUEENSLAND. 1873–86.	ENGLAND. 1871–80.
134·9	100·7	108·6	143·1	211·6

The mortality from consumption in Queensland is somewhat augmented by the deaths of phthisical patients who resort there for health, and also from the greater liability to the disease of the Polynesian race, which is here in larger proportion to the entire population than in the other Colonies.

Tabes Mesenterica and *Tubercular Meningitis* are less prevalent in Australia than in England.

Rickets is exceedingly rare in Australia. On an average only one death from this affection is recorded annually in New South Wales.

I am unable to decide as to what extent *Scrofula* prevails in Australia generally; it does not, however, appear to be widely prevalent. The ratio of deaths from scrofula in South Australia for the ten years ending 1887 was 4·5 per 1000.

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[1] Thomson, *Germ Theory of Phthisis*, Melbourne 1882.

Diseases of the Liver, other than *Cirrhosis,* caused an average death-rate of 298 per million in New South Wales during the period 1877–86. Of these, 77 were ascribed to hepatitis, 49 to jaundice, and 172 per million to other diseases of the liver.

Diseases of the Spleen give rise to the very small ratio of 3·2 deaths per million living.

Anæmia, Chlorosis, and *Leucocythæmia* together give rise to an average death-rate of 24 per million in New South Wales, which shows what an insignificant factor anæmia forms in Australian pathology.

The following are the death-rates from *Cancer* in the different Colonies per 100,000 living, for the years 1882–86 :—

VICTORIA.	SOUTH AUSTRALIA.	NEW SOUTH WALES.	QUEENSLAND.	WESTERN AUSTRALIA.
47·0	32·0	28·4	24·9	36·0

In the decennium 1871–80 the death-rate for cancer in Victoria was 37·1, which indicates that, as in England and elsewhere, cancer is increasing in frequency in the southern Colonies.

Syphilis is less frequent in Australia than in most parts of the globe. The average death-rate from this disease in New South Wales, during the ten years ending 1886, was 36·5 per million. Venereal diseases, as a class, caused a mortality during the same period of 49·2 in New South Wales, and of 47·1 in Victoria for the period 1871–80, as compared with a death-rate of 95·6 per million in England for the five years 1876–80.

Diabetes is of rare occurrence in Australia, the death-rate averaging from 18 to 20 per million—a ratio about half of that which obtains in England.

Rheumatic Fever and *Rheumatism of the Heart* are comparatively rare. The mortality from these affections in Queensland, in 1887 and 1888, was 53·8; in New South Wales (1886–87), 34·7; and in South Australia, in 1889, 31·9 per million; while the average mortality in England is 95 per million. Heart disease is nevertheless frequent.[1]

Rheumatism, on the other hand, is about equally fatal in Australia and in England. In South Australia the death-rate from rheumatism, in 1889, was 31·9 ; in New South Wales, 1886–87, it was 35·8 ; in Queensland, 34·9 ; while in England the average of the four years 1881–84 was 35 per million.

Convulsions is one of the most fatal of infantile diseases in the Australian Colonies. The mortality ascribed to this cause in Queensland for the five years ending 1888 was 98·4 per 100,000, and in New South Wales the average for the ten years 1877–86 was 86·5 per 100,000, as compared with the English average (1881–84) of 85·5. It would appear that convulsions are more fatal in the warmer climates of the north. In 1886, I find it stated that the mortality in Victoria from this disease was only 34 per 100,000.

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[1] Australia occupied the second place, as regards the mortality from diseases of the circulatory system, while it was occupied by British troops,—the first being taken by the Cape.

Atrophy and Debility, almost entirely confined to infants and young children, are very fatal in Australia, as will be seen by the following figures, showing the mean mortality from these affections per 100,000 for the years 1882–86, and in England for the year 1884:—

VICTORIA.	SOUTH AUSTRALIA.	NEW SOUTH WALES.	QUEENSLAND.	ENGLAND.
98·0	112·0	104·2	124·5	92·1

Hydatids.—From the large development of sheep farming in Australia, we need not be surprised that hydatids cause a comparatively large number of deaths. The average death-rate per 100,000 from this cause, during the period 1882–86, was as follows:—

VICTORIA.	SOUTH AUSTRALIA.	NEW SOUTH WALES.	QUEENSLAND.
5·79	3·54	2·05	1·29

Leprosy is only met with among the Chinese and other coloured immigrants. I find no mention of its occurrence among the aborigines, and the European colonists are exempt from the disease. In 1890, 5 cases were known in Victoria, 13 in New South Wales, and a few—how many is not accurately known—in Queensland.[1]

DISEASES OF THE ABORIGINES.

We shall now briefly state what is known of the diseases prevalent amongst the aboriginal population. Unfortunately, our knowledge, so far as it is exact, is chiefly restricted to those living more or less in contact with Europeans, and therefore under what may be called artificial conditions.

Intermittent Fever.—Taplin, referring to the Narrinyeri tribe, says, "I have never known a case of intermittent fever amongst them."[2] Amongst the aborigines on the Government Stations a low form of intermittent (probably not malarial) is observed.

Smallpox.—We have stated, on the authority of Hirsch, that smallpox was introduced towards the end of 1838, but this can only be understood as applying to the European colonists. There can be no doubt that smallpox broke out among the natives shortly after the settlement of New South Wales[3] in 1788. In 1789 the disease, called by the natives *gal-gal-la*, was so destructive that the dead and dying were found lying about in the bush; and the medical officers who examined the sufferers pronounced it to be smallpox. The remarkable thing connected with this outbreak was, that none of the Europeans that accompanied Governor Phillip suffered from the disease, and I do not think that it has been shown to have been present in the ships of M. de la Perouse, who had a short time before visited Botany Bay. It is further to be noticed that the natives had already a name for it, a fact which has been supposed to indicate a previous knowledge of the malady. Little significance is to be attached to this fact, unless we knew what the meaning of the word *gal-gal-la* really was. I have known an outbreak of smallpox in an out-of-the-way part of Madagascar styled *aretina mafy*, or the bad disease; but it is evident that such a designation is of no value as proving a previous acquaintance with the disease or otherwise. Barbarous tribes will often apply such a general term to a disease, whether new to them or not; and, after a few years, the same general name may be given to a quite different malady. The strongest argument against the disease having been endemic in Australia is its extreme fatality. Had smallpox been endemic in the country, and had it been as fatal before as it has proved since the European colonisation, it would have destroyed the race. Certainly it has largely contributed since the European settlement to the destruction of the aborigines. There can be little doubt that the disease called *meen waranna* ("chopped root"), which prevailed among the aborigines of New South Wales and Victoria in 1830, and probably again in 1837, was smallpox. Dawson says that he saw, in 1844, an aboriginal, of the Hopkins' River tribe, as thoroughly marked with smallpox as ever he saw a white man.[1] It has been generally supposed that the symptoms and course of smallpox are pretty uniform, so that with the developed disease little difficulty in diagnoses can occur. This, I think, is an error. I have known the disease assume such exceptional characters amongst African races, that experienced men have been deceived. The disease has more than once presented peculiar characters among the aborigines of Australia.

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[1] Creed, *Australian Medical Gazette*, March 1890.

[2] Smith's *Aborigines of Australia*, Melbourne and London 1878.

[3] Collins, *The English Colony in New South Wales*, 1804, p. 58, quoted by Smith, *Aborigines of Victoria*.

Measles and Scarlet Fever.—I have met with no evidence that either of these diseases has ever prevailed epidemically among the nomad natives. Mr. Taplin, whose experience seems to have been limited to the Narrinyeri tribes, states that he had never known a native to have measles or scarlet fever, even when associated with Europeans among whom it has prevailed; but it is certain that they are not immune to these maladies, for the natives at the Government Stations in Victoria suffer from both diseases when they are prevalent.

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[1] Dawson, *Australian Aborigines*, Melbourne 1881.

Whooping-Cough prevails among the aborigines at the present day, but I have been unable to discover whether it is endemic in Australia, or is one of the many fatal gifts which the settlement of Europeans has bestowed on the unhappy natives.

Influenza.—The natives, according to Taplin, are very subject to "epidemic influenza," which they call *nruwi.* We also find influenza mentioned among the common diseases from which the natives at the Government Stations suffer. Whether this disease is to be identified with true epidemic influenza is doubtful.

Dysentery and *Diarrhœa* are far from rare among the native races.

Respiratory Diseases.—It is stated by Dawson that "the natives were not subject in former times to pulmonary complaints, though they were very much exposed to the weather, but that, since the introduction of European clothing, they are very liable to affections of the lungs." This may be supposed to be owing to their intermittent or irregular use of such clothing. I may, however, remark that we have no positive proof of this alleged comparative immunity of the natives from chest complaints in former times. It may be a fact, but it is not one that has been, or can be, established. All observers agree that at the present day those tribes living more or less in contact with Europeans suffer to a large extent from pneumonia, chronic bronchitis, and phthisis. It is stated by an observer, quoted by Smith, that "eight-tenths of the mortality among the aborigines of Victoria arises through intemperance, bringing on pulmonary disorders—pleurisy, pneumonia, and consumption."[1]

Scrofulous Diseases are undoubtedly common, at least among many of the tribes. Taplin asserts this of the Narrinyeri, who, he says, sometimes die of induration and ulceration of the glands before puberty. Amongst those who reside at the Government Stations we find glandular swellings (presumably scrofulous) mentioned as of frequent occurrence. *Tabes Mesenterica* and *Hydrocephalus* are not unknown; the former, indeed, appears to be rather frequent.

Venereal Diseases are common, especially among the native women. Syphilis is believed not to be endemic in Australia, but to have been introduced by Europeans. Curr remarks that syphilis is now so common that this disease alone would probably suffice to exterminate the aborigines.[2]

Rheumatic Diseases, both muscular and as affecting the joints, are common; and pericarditis (but whether of rheumatic origin is uncertain) is enumerated among the fatal diseases of the aborigines.

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[1] Smith, *Op. cit.*

[2] *Victorian Year-Book*, 1887-88, p. 372.

Ophthalmia is of frequent occurrence, sometimes terminating in blindness.

A virulent form of *Pustular Itch*, forming scabs, which spread and join each other until they almost cover the lower extremities, is very prevalent, both among the inland and coast tribes.

A kind of boil, known as *mirra*, seems to be peculiar to the aborigines. Large blind boils form under the arms, in the groin, or on the breast or thighs, varying in size from a hen's egg to that of an emu. Every native suffers from this disease once in his life, and it lasts for months or sometimes for years. Its nature is unknown.

Australia thus presents us with the spectacle of a continent, from the pathology of which entire classes of diseases, prevalent in other divisions of the globe, were, until comparatively recent times, completely absent. Thus the whole class of eruptive fevers,—small-pox, scarlet fever, and measles,—so fatal elsewhere, were unknown. Epidemic cholera, relapsing fever, yellow fever, whooping-cough, and diphtheria were equally absent, as was also syphilis, that terrible scourge to the human race in other parts of the world. Whether the gonorrhœal infection existed in Australia before its colonisation is uncertain. Leprosy was also absent from the Southern Continent and from Tasmania, although it was endemic in New Zealand, which was peopled by a different race, and at a much later period. Are we to conclude from the absence in Australia of these specific infective diseases, that, when the aborigines separated from the rest of the human family to take up their abode in Australia, none of these destructive plagues had as yet been evolved? Subsequent experience has, at least, shown that the immunity of the aboriginal races from these maladies, before the arrival in their midst of Europeans, was not owing to any peculiarities of climate or of race.

While so many of the specific infections prevalent elsewhere were unknown, we find, on the other hand, that the inflammatory diseases of the viscera, such as bronchitis, pneumonia, diarrhœa, liver, kidney, and rheumatic diseases, were common to Australia and the rest of the world, while some of the more specific affections, such as consumption, scrofula, and dysentery, were fully represented in Australian pathology. No infectious disease peculiar to the continent became developed during the long ages in which the race remained isolated from the rest of the world. It appears highly probable that typhoid fever was quite common in Australia before the arrival there of Europeans, vindicating the title conferred on it by Hirsch of "an ubiquitous disease."

CHAPTER XI.

TASMANIA.

GEOGRAPHY.—Tasmania is situated to the south of Australia, from which it is separated by Bass Strait. The island is 240 miles long by 200 broad, with an area of 26,375 square miles. It differs entirely in its physical features from the neighbouring continent. It may be briefly described as a land of mountains, streams, and lakes. The soil is either alluvial, or consists of tertiary clays and loamy soils, derived from the decomposition of different kinds of basalt. The population of the Colony in 1887 was estimated at 142,478.

CLIMATOLOGY.—The following are the mean resultants of observations of temperature, daily range, and rainfall, taken at Hobart, the capital, from 1841 to 1879 :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	63·22	62·55	60·20	55·68	50·76	47·48	45·59	48·97	51·86	55·01	57·28	61·69 = 55·1
Daily Range, .	21·04	20·47	20·22	17·92	16·00	15·56	15·56	17·03	18·03	19·32	19·31	20·32 = 18·4
Rainfall, . .	1·45	1·54	1·55	1·78	1·84	1·98	2·20	1·86	2·14	2·05	2·87	1·67 = 22·93

The mean marriage-rate is 14·04, the birth-rate 31·59, and the death-rate 15·33 per 1000.

PATHOLOGY.—*Malarial Diseases* are practically unknown in Tasmania. The death-rate from ague, in the decade ending 1887, was 3 per million.

Remittent Fever is also rare.

Enteric Fever is the most fatal febrile disease of the island, although it is less prevalent in Tasmania than in any of the other Australasian Colonies. The average death-rate from 1873 to 1886 was 34·9 per 100,000 living.

The monthly percentage of deaths from enteric fever, calculated on the six years 1882–87, is shown in the following table. The months are arranged, beginning with July, which is the coldest month in Tasmania, corresponding with the month of January in England. We add, for comparison, the monthly percentage of hospital admissions for enteric fever in London, and the average monthly mean temperature of Greenwich :—

TASMANIA.

MONTHLY MEAN TEMPERATURE, AND MONTHLY PERCENTAGE OF DEATHS FROM ENTERIC FEVER.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.
Mean Temperature,	45·59	48·97	51·86	55·01	57·78	61·69	63·22	62·55	60·20	55·68	50·76	47·48
Fever Deaths, .	6·20	3·25	2·93	3·83	2·36	3·83	8·55	11·21	16·52	17·11	15·93	8·26

ENGLAND.

MONTHLY MEAN TEMPERATURE, AND MONTHLY PERCENTAGE OF ADMISSIONS FOR ENTERIC FEVER IN LONDON.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	36·6	38·8	41·1	46·1	52·5	57·3	61·7	60·9	56·6	49·6	42·4	39·1
Fever Deaths, .	7·4	4·6	5·1	3·4	3·8	6·1	8·3	12·5	13·6	14·3	12·5	8·4

Both in England and Tasmania enteric fever attains its maximum in the autumn season. In Tasmania, the months of March, April, May, and June are dry months; in England, the third and fourth quarters are the most rainy. This seems to indicate that the period of typhoid prevalence is determined by the temperature and not by the rainfall.

Diphtheria is a fatal disease in Tasmania, as in the other Colonies, the mortality during the ten years 1876–87 reaching 28·7 per 100,000. It seems to be most fatal in the second quarter. It was observed for the first time in Tasmania, in the month of January 1859,[1] breaking out almost simultaneously in two of the inland districts. The deaths from croup in 1887 numbered 14·3 per 100,000 living.

Diarrhœal Diseases are less prevalent in Tasmania than in the Colonies on the mainland. The ten years' average for diarrhœa (1876–87) was 6·50; for dysentery, 1·56; and for cholera nostras, 0·41 per 10,000.

Smallpox is not endemic in the Colony. No death from the disease occurred between 1869 and 1886.

Measles first visited Tasmania in 1854. It is sometimes entirely absent for several years in succession, after which it appears in an epidemic form, causing, however, only a moderate mortality.

Scarlet Fever, which was observed for the first time in 1843, occasions a small mortality in Tasmania compared to that of most countries in Europe.

The average death-rate from measles (1876–87) was 5·4; that from scarlet fever, 4·9 per 100,000.

Influenza has been several times epidemic in the Colony. In 1851–52 it was very prevalent here, as in the other Australian Colonies. Animals, especially dogs, were largely affected. In 1860, Tasmania was attacked a month after it had made its appearance in the other Colonies.

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[1] Hall, *Trans. Epidem. Soc.* vol. ii. 1867.

The death-rate from *Bronchitis* for the ten years ending 1887 was 6·60; that from *Pneumonia* (1883–87), 5·76 per 10,000; both diseases are thus rare in the Colony. *Pleurisy* is moderately fatal. *Phthisis* caused a mean mortality of 104·6 per 100,000 during the fourteen years 1873–86.

Cancer is more fatal in Tasmania than in the other Australian Colonies, the death-rate from 1882–86 being 48·2 per 100,000. If we are to accept the view propounded by some pathologists, that cancer is a disease of civilisation, then we should conclude that civilisation is considerably more advanced in Tasmania than on the mainland.

Convulsions give rise to an average death-rate of 87·0 per 100,000, and *Atrophy* and *Debility* to one of 93·9 per 100,000.

Leprosy is unknown in Tasmania.

Hydatid Disease is rather common, giving rise to a death-rate of 2·83 per 100,000.

PATHOLOGY OF THE ABORIGINES.

The records of the pathology of the now extinct aborigines are extremely scanty.

Pulmonary Complaints, particularly inflammation of the lungs, is stated by Widowson to have been excessively prevalent among them in the early part of the century.[1] *Consumption* was also of frequent occurrence, and these lung affections seem to have contributed considerably to the extinction of the race. The aboriginal Tasmanians are also stated to have been liable to loathsome ulcerated sores. Many of the adults were crippled with *Rheumatism*. It is conjectured that, prior to the colonisation of the island by the whites, a large number of persons had been carried off by *Smallpox*, introduced, perhaps, by some exploring vessels.

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[1] Widowson, *Present State of Van Diemen's Land*, 1829; see H. Ling Roth's *Tasmanians*, London 1890, and Smith's *Aborigines of Australia*.

CHAPTER XII.

NEW ZEALAND.

Geography.—New Zealand consists of three islands, the north, the middle, and the south, or Stewart Island. These extend over nearly thirteen degrees of latitude, from 34° to 47° S., with an area of upwards of 100,000 square miles. The islands are of volcanic origin. In the north island the mountains occupy about one-tenth of the surface, but with the exception of a few peaks, such as Mount Egmont (8300 feet) and Ruapehu (9100 feet), they are not of any great height. The middle island is intersected throughout almost its entire length by the Southern Alps, rising in Mount Cook to an altitude of 12,349 feet. New Zealand is watered by numerous rivers, many of which overflow from the melting of the snow upon the mountains. Much of the soil in the valleys and plains is clayey. The vegetation is rich, and extensive tracts are covered with forest and marsh. The north island is famed for its lakes, geysers, and hot springs.

The estimated population of the several provinces in 1888 was :—

Auckland,	136,413	Nelson,	31,414
Taranaki,	19,252	Westland,	16,392
Hawke Bay,	26,250	Canterbury,	127,616
Wellington,	82,309	Otago,	155,693
Marlborough,	11,828		

The total European population of the Colony at this date was 607,167. The native, or Maori, population, according to the census of 1881, numbered 41,969.

Climatology.—The following table gives the mean temperature, F., of the four months, January, April, July, and October, and that of the year at certain stations on both coasts from north to south :—

Station.	Latitude.	Jan.	April.	July.	Oct.	Year.
Auckland,	36° 50′ (east coast)	67·8	61·7	51·8	57·7	59·5
Taranaki,	39° 40′ (west coast)	65·7	59·4	50·7	55·8	57·6
Christchurch,	43° 33′ (east coast)	62·4	53·4	43·0	53·2	52·7
Hokitika,	42° 42′ (west coast)	60·3	54·7	45·0	52·0	52·9
Dunedin,	45° 52′ (east coast)	57·9	52·0	42·6	51·3	50·7

The mean daily range in Auckland for the year 1888 was 12°·5, and in Dunedin 14°·6 F.

The rainfall is more abundant on the west than on the east coasts of both islands, and is somewhat more copious in the south than in the north island.

The average annual rainfall of Auckland is 43·179 inches; that of Dunedin, 34·672 inches.

The heaviest rains are from May to August.

VITAL STATISTICS.—The average marriage-rate (1879–88) was 13·24; the birth-rate (1880–88), 31·22; and the average death-rate for the same period, 10·74 per 1000. After adjustment for age, according to the proportions existing in the population of England and Wales, the death-rate in 1886 was 12·82 against that of 19·28 in England. This is the best possible proof of the salubrity of the climate. The deaths of children under one year of age to 100 births is 9·65, which is lower than in any of the neighbouring Colonies. In Auckland, the maximum mortality falls on the first quarter, which corresponds with the hot season; in Otago, on the other hand, in the south, it is the third quarter in which the deaths are most numerous.

PATHOLOGY.—*Malaria.*—New Zealand appears to be entirely exempt from malaria, if by this we are to understand the cause of ague. The class of malarial diseases, which includes remittent fever as well as ague (the former of which is more frequently than otherwise not of malarious origin in temperate climates), gave a death-rate of 0·05 per 10,000 of the population for the three years 1886–88. During the war of 1862–65, the troops in New Zealand were exposed to all the trials of campaigning—"road-making, sometimes in swampy districts and through bush, constant exposure to sun and rain, fatiguing marches, desultory combats by night and by day, sleeping out among high grass and fern, and wading streams waist deep." Notwithstanding all these hardships, which were well calculated to bring to light any malarial element in the climate, M'Kinnon states that there was not only an entire absence of malaria, but that the sickly, sallow, worn-out men from India were speedily restored to health.[1]

Typhoid Fever.—New Zealand enjoys no such immunity from enteric fever as from malaria. The average death-rate from this cause during the period 1873–86 was 38·7 per 100,000. Although this is a lower ratio than that which obtains in any of the Australasian Colonies, with the exception of Tasmania, still it is high compared to that of England.

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[1] *Army Medical Report*, 1865.

During the two years 1887 and 1888, the mortality from typhoid was highest in the northern districts of Auckland and Hawke Bay, and lowest in Otago. If this is the rule in New Zealand, then we shall find, as on the continent of Australia, a decrease of the disease according to latitude, and a diminishing mean temperature. I do not have the means of deciding whether this rule of distribution holds good on an average of a number of years.

Typhoid fever is most prevalent from March to May.

Typhus Fever, *Relapsing Fever*, and *Epidemic Cerebro-spinal Fever* are not met with in the Colony.

Whooping-Cough is moderately fatal, causing an average death-rate of 27·7 per 100,000 from 1883–88.

Diphtheria and *Croup* occupy a less prominent place among the causes of death in New Zealand than they do in Australasia generally. The average death-rate from diphtheria for the six years 1883–88 was 17·9 per 100,000; that from croup for the year 1888 was 12·56, giving for the two diseases a ratio of 30·46 per 100,000.

Diarrhœal Diseases, including simple cholera, diarrhœa, and dysentery, are by no means excessively prevalent; the average death-rate for the three years 1886, 1887, and 1888 having been 64·4 per 100,000. They are more prevalent in the north than in the south, in warm than in cold summers, and are most prevalent during the warm season. During the very cold year 1888, the deaths from diarrhœa fell to half their usual number.

Smallpox is rarely seen in the Colony.

Measles in New Zealand, as in the other Australian Colonies, becomes practically extinct for a certain time, and then reappears in an epidemic form. One death only was registered from measles in 1885; in 1888 there were 5 deaths; and in 1889 there were 2 deaths. The mean death-rate from measles from 1878 to 1887 was 6·40 per 100,000; that from scarlet fever during the same period, 7·50 per 100,000.

Diseases of the Respiratory Organs caused an average death-rate of 128·0 per 100,000 in New Zealand during the three years 1886–88.

The death-rate from *Bronchitis* in 1888 was 45·94; that from *Pneumonia*, 39·80; and from *Pleurisy*, 6·28 per 100,000.

Comparing the death-rate of Auckland in the north for 1888 with that of Otago in the south from these three diseases, we have the following ratios per 100,000 living:—

	Bronchitis.	Pneumonia.	Pleurisy.
Auckland, ...	36·0	29·4	6·6
Otago, ...	48·9	47·5	9·7

It thus appears that, for this year at least, the colder climate of Otago furnished larger ratios of deaths from all these diseases than the warmer province of Auckland. They are here essentially diseases of the cold season.

Phthisis is comparatively rare amongst the colonists, the mean death-rate from the disease from 1873 to 1886 being only 86·4 per 100,000. New Zealand has thus a lower phthisical death-rate than any of the Australasian Colonies.

Diseases of the Liver, other than cirrhosis, caused 13·55 deaths per 100,000 living in 1888,—a proportion differing little from that which obtains in England.

Diseases of the Spleen, as might have been expected from the absence of malarious disease, are very rare.

Anæmia, Chlorosis, and *Leucocythæmia* furnished in 1888 a death-rate of 2·6 per 100,000,—a ratio similar to that caused by the same group of diseases in Australia, and considerably lower than that which obtains in England.

Cancer caused an average death-rate of 32·6 per 100,000 during the ten years ending 1888; but the deaths from this disease are increasing rapidly in New Zealand; for, while the ratio was 26·3 per 100,000 in 1879, it has risen to 43·4 in 1888.

Venereal Diseases are exceedingly rare among the New Zealand colonists. The deaths from this class of diseases during the three years 1886–88 having been only 27 per million living.

Diabetes.—I cannot give the average mortality from this disease, but in 1888 the deaths were in the proportion of 43 per million, which is close upon the English average, and about double that of the Australian Colonies.

Rheumatic Fever is credited with a death-rate of 36, and rheumatism with one of 44, per million in 1888. From this we conclude that rheumatic diseases are not of a grave nature in New Zealand.

Convulsions, which cause a great infantile mortality in Australia, are by no means so fatal in New Zealand.

Debility, Atrophy, and *Inanition* are also conditions which give rise to a very low mortality in this Colony; the average death-rate (1882–86) from these diseases was 55·7 per 100,000 living.

Hydatids are very much less common in New Zealand than in Australia; the average death-rate (1882–88) being 0·66 per 100,000.

DISEASES OF THE ABORIGINES.

The Maories suffer from the *diarrhœal* class of diseases to a greater extent than the English. Diseases of the lungs are also very common amongst them, especially *phthisis*, which frequently manifests itself in its earliest stage by hæmoptysis.

Scrofula is said by Thomson to be the curse of the native race. In some districts 20 per cent., in others 10 per cent. of population, are said to bear on their bodies marks of the king's evil.

Scrofulous Ophthalmia, ending in blindness, is common.

Heart Diseases are rare.

Goitre, *Cretinism*, and *Epilepsy* are unknown.

Scurvy, *Cancer*, and *Elephantiasis* are very uncommon.

Syphilis, which appears to have been introduced into New Zealand by Europeans, is, at the present time, neither widely prevalent nor specially malignant.

Leprosy, known as "Ngerengere," is endemic amongst the Maories, but to what extent it prevails is not accurately known.

CHAPTER XIII.

POLYNESIA.

FIJI.—The Fiji Group, numbering about 255 islands (eighty of which are inhabited), lies between 15° and 22° S. lat., and between 176° E. and 178° W. long. The two largest islands are Viti-Levu, with an area of 4250, and Vanua-Levu, with an area of 2600 square miles. The population of the whole group is estimated at 124,648. The Fiji Islands are of volcanic origin, and are surrounded by coral reefs. The interior is generally hilly, some of the mountains rising to elevations of from 2000 to 4500 feet. Alluvial plains skirt the shores, and are traversed by numerous small rivers and streams, which, when swollen by the heavy rains, often inundate them.

The subjoined table gives the mean temperature and rainfall of Levuka, on the island of Ovalau, for 1877:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature, .	81·3	82·3	81·6	80·6	80·4	76·0	74·3	73·0	74·0	75·8	78·3	81·2
Rainfall, . . .	12·20	8·29	12·67	4·12	0·76	6·97	7·16	11·04	2·79	5·70	0·03	0·88

In 1887 the birth-rate of Fiji was 37·8, and the death-rate 34·8 per 1000. The death-rate of the group presents a strong contrast to that of the Australian Colonies.

PATHOLOGY.—*Malaria.*—Malarious diseases are of less frequent occurrence in Fiji than its tropical position might lead us to suppose.[1]

Typhoid Fever is far from rare, but the extent to which it prevails among the natives is unknown.

Epidemic Diphtheria is unknown.

An epidemy of *Cerebro-spinal Meningitis,* limited to emigrants from New Britain, New Ireland, and some other islands, but which spared the natives, occurred in 1885. Three white children, however, were attacked and died. The manner of distribution suggested the probability of the disease being infectious from man to man. The total number of cases was 128, of which 90 proved fatal.

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[1] Horne, *A Year in Fiji*, London 1881; Williams, *Fiji and the Fijians*, London 1858.

Dengue appeared for the first time in this group in 1885.[1]

Diarrhœa and *Dysentery* are to be looked upon as among the most fatal maladies of the Europeans and natives. The Polynesian emigrants to Fiji are much more liable to dysentery than the natives. An epidemic gangrenous stomatitis, with an analogous condition of the rectum, forms the most fatal of all the diseases which Corney has met with in the South Seas. This disease appears to be similar to the Caribi of Guiana, and the Ėl Bicho of Brazil.

Smallpox has never been known to occur in these islands; although *Varicella* occurs in an epidemic form once or twice a year. *Scarlet Fever* is unknown.

Measles was introduced from Australia into Fiji in 1875, when, according to Corney, it carried off 40,000 of the inhabitants. It may now be regarded as endemic in Fiji.

Influenza.—Corney has, during eight years' residence, noticed several epidemic outbreaks of influenza. It appears at Batiki and Nairai about a week earlier than at Bau and Levuka, and about a fortnight later it declares itself at Suva. He considers that it is spread chiefly by the agency of the trade winds, which blow generally from east-south-east.

Bronchitis is rather rare than otherwise; but *Pneumonia* is of more frequent occurrence. *Phthisis* is stated to be very prevalent; and *Scrofula* is also frequently met with amongst the Fijians. *Syphilis* does not appear to be widely diffused.

Yaws, here called *Coko*, is endemic to the group. "Most of the native children," Williams remarks, "have this disease; and those who escape are said to grow up sickly and feeble, and incapable of much exertion,—an opinion which, I believe, is well founded."[2]

Venereal Diseases are rare in Fiji. *Elephantiasis* is common.

New Caledonia lies between Australia and the Fiji Group, about 700 miles east of Queensland. It is about 200 miles in length and 30 miles in breadth. It is volcanic and mountainous. The coasts and valleys are in many places covered with forest, and contain a considerable extent of marshy ground.

The following, according to Dutroulau, is the monthly mean temperature, C.:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
24·6	27·6	23·6	23·6	22·3	26·6	20·7	20·0	21·7	23·1	23·3	24·8

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[1] Corney, *Trans. Epidem. Soc.* 1887–88.

[2] Williams, *Fiji and the Fijians*, London 1858.

Malaria.—Dutroulau states that no grave endemic malady has been observed in New Caledonia, notwithstanding the clearings necessary in planting the Colony, and the night and day marches imposed on the troops by military expeditions.[1]

Typhoid Fever, with the same symptoms as in Europe, is, according to Dutroulau, very prevalent; but it is doubtful if this applies to the natives, as Boyer only met with two cases amongst them.[2]

Diphtheria.—A fatal form of throat affection, allied to diphtheria, has been epidemic among the natives (Lombard).

Dysentery, but not of a severe character, and *Diarrhœa* are not uncommon.

Whooping-Cough is noticed as occurring amongst the Canaques, and, according to Lombard, *Influenza* is also met with.

Smallpox was introduced into the island in 1859, and continued apparently up to 1868; whether it still exists at the present time, I have not been able to ascertain. *Measles* and *Scarlet Fever* appear to have been noticed of late years; but the latter disease, if it really exists in the island, is probably confined to the white population.

Phthisis, Pneumonia, Pleurisy with effusion, and *Bronchitis,* are to be regarded as the most fatal diseases of the natives, while *Adenia* and *Scrofula* are also widely prevalent. *Rheumatic Diseases* are of frequent occurrence, and *Rheumatic Endocarditis* is far from rare. I understand that *Leprosy* has recently appeared in the Colony.

Hepatitis is very seldom seen. Boyer only met with two cases of *malignant disease,* and these were epithelioma of the lower lip, occurring in smokers.

The New Hebrides, situated to the north of New Caledonia, are of volcanic origin. They are mountainous and well wooded; no true marshes exist. The mean annual temperature of Tanna is 86°. The island of Tanna is more unhealthy than Aneityum. This group is malarious. In respect to the prevalence of malaria, the New Hebrides present a contrast to the Fiji Islands on the one side and to New Caledonia on the other. *Tuberculosis* and *Caseous Pneumonia* are the most fatal diseases of the natives.

The Friendly or Tonga Islands, situated to the south-east of Fiji, are stated by Dr. Saffre to be free from malarial fever, but they are subject to dysentery. Their pathology differs little from that of the Fiji Group.

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[1] Dutroulau, *Malad. des Européens dans les pays chauds.* Paris 1868.

[2] Boyer, *Archiv. de méd. nav.* vol. xxx. 1878.

THE SAMOAN OR NAVIGATOR ISLANDS, in 13° 30′ to 40° 30′ S. lat., and 168° to 173° W. long., include Savaii, Mauna, Tutuila, Upolu, and Rose Islands. With the exception of the last, they are all of volcanic origin. They have a considerable extent of plain along the coast, with here and there marshy tracts.

Ague and *Dysentery* are the most prevalent diseases in this group.[1] *Influenza,* according to Turner, appeared in this group for the first time in the year 1830, directly after the arrival of the vessel which brought the missionaries. *Smallpox* is unknown. *Syphilis* is moderately prevalent. *Frambœsia* is endemic in this group.

THE SOCIETY ISLANDS, in lat. 16° to 18° S., and long. 148° to 155° W., number thirteen in all, of which Tahiti is the best known. They consist of a central mountain mass, covered with vegetation, and of a coast fringe of level or gently sloping plain, which, as a rule, is just raised above the level of the almost tideless sea.

The mean annual temperature of Tahiti is 76° F. April, the warmest month, has a mean temperature of 85°, and August, which is the coldest month, has a temperature of 67°. The rains are heavy and the vegetation luxuriant. During the rainy season the plains become marshy.

PATHOLOGY.—*Malaria.*—*Ague* is rare in Tahiti and Raitea, but is more prevalent in the island of Taha, where there is much marshy ground.

Typhoid Fever is endemic in this group. It is met with both amongst the Europeans and natives. According to Dutroulau, it assumes an epidemic form at long intervals, as in 1847, 1849, and 1853–54.

Influenza, according to the somewhat antiquated statement of Ellis, appears in these islands on the arrival of a foreign ship. This is what was observed in Samoa in 1830, and what is observed so frequently in Iceland and the Faroë Islands at the present day.

Dysentery, Diarrhœa, and *Sporadic Cholera* form a considerable proportion of the total mortality, being specially fatal to the young during the warm season.

Tahiti has repeatedly suffered from epidemies of *Smallpox* and *Measles. Scarlet Fever* has also been introduced into this group, where it shows itself from time to time, but in a mild form.

Bronchitis and *Pneumonia* are far from rare. *Phthisis* forms quite an important factor in Tahitian pathology. Nearly one-fourth of the mortality amongst the native population is ascribed to consumption.

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[1] Fox and Farquhar, *Endemic Skin Diseases,* London 1876.

Hepatitis is met with, but is, upon the whole, rare.

Rheumatism, acute and chronic, forms about 4 per cent of the diseases treated.

Syphilis is very prevalent in Tahiti, but does not assume a grave type.

Leprosy, known as *Oovi*, is met with among the natives, but not to a large extent.

Scrofula and *Tabes Mesenterica* are frequent diseases among the native children.

THE SANDWICH OR HAWAIIAN GROUP lies in lat. 19° to 22° N., long. 150° to 160° W. The principal islands are Hawaii, Oahu (in which is situated the capital, Honolulu), Maui, and Kauai. They are of volcanic origin, the more prominent peaks rising to an elevation of nearly 14,000 feet. The soil is of decomposed lava and sand, which, in the valleys, is mixed with vegetable mould. The extremes of temperature in the shade are 90° and 53° F.; the daily range is 12° F. Rains are frequent and abundant. January is the coldest, and August the warmest month. The estimated area of Hawaii is 6677 square miles, and the population, in 1884, was 80,578. The population of Honolulu, in 1889, was estimated at 25,000. The annual death-rate of the town in 1889 was 21·92; but that of the native population was 29·00 per 1000.

PATHOLOGY.—*Malaria.*—This group is free from intermittent fevers. A remittent fever has been observed in Kauai and Waimea, having remissions almost identical with those of typhoid fever; but no cases of this form of fever are noticed after the heavy rains set in. The fever is probably not malarious.

Typhoid Fever is specified as the cause of only 2 deaths in Honolulu in the Board of Health Report of 1889, and of 11 deaths in 1890; but the deaths returned as due to fever, the nature of which is unspecified, were 47 in the former year and 87 in the latter. As the country is not malarious, it may, perhaps, be safe to conjecture that the "fever" here referred to is mainly tropical typhoid. The total fever death-rate for these two years averaged 2·92 per 1000 in the capital. The fever season extends from December to April or May.

Diphtheria is not unknown, as three deaths are ascribed to it in 1890. Whether this is the same disease as the croup signalised by Chapin, as quoted by Hirsch, is uncertain.

Influenza is mentioned by Lombard as being of frequent occurrence in this, as in the other Polynesian groups. The great pandemy of 1889–90 visited this group in the beginning of 1890, and caused a considerable mortality.

Whooping-Cough is stated by Hirsch to have made its first appearance in this group "towards the end of the thirties as a widespread epidemic, but has not recurred there down to 1855." In 1888–89 only 1 death was recorded from whooping-cough, while in 1889–90 the deaths from this disease numbered 13,—a ratio of 0·52 per 1000 living.

Dysentery, in 1889–90, gave rise to a mortality of 1 per 1000; *Diarrhœa,* to 1·6 per 1000; *Cholera Infantum,* to 0·24 per 1000; and *Enteritis,* to 0·16 per 1000,—a total mortality from this class of diseases of 3·00 per 1000. Dysentery and diarrhœa both appear to be most fatal from December to March.

Pneumonia and *Bronchitis* are stated to be of frequent occurrence; but, from the returns before me, they do not appear to be more than moderately fatal. *Consumption,* however, is prevalent, causing in Honolulu an average death-rate (1888–89 and 1889–90) of 2·4 per 1000.

Hepatitis, according to Chapin, is rare,[1] and I find no death recorded from it in Honolulu in the reports to which I have referred; and all accounts agree in stating that it is extremely rare among the natives.

Rheumatism is said by Bechtinger to be amongst the most common maladies in this group.[2]

Scrofula is endemic to a large extent in this group, as in the Polynesian Islands generally.

Syphilis was unknown in the Sandwich Islands before the visit of Cook in 1779. When Chapin wrote, in 1839, the disease was excessively prevalent and malignant; but, according to later accounts, it has become less common, and apparently has assumed a milder type amongst the natives.

Leprosy was unknown in the Sandwich Islands until about the year 1840, when it is believed to have been introduced by Chinese emigrants. It has now become diffused to an extraordinary extent among the native population. The island of Molokai has been set aside as a leper settlement. The number of lepers interned at Molokai in 1890 is given at 1159; and this by no means represents the full extent of the evil, for many lepers are to be found outside the leper settlement. We will probably be under-estimating the proportion of lepers to the general population if we place it at 1 in 60. The manner in which leprosy has spread in this group, and its extension in some instances to the white attendants on the lepers, seems to indicate that it may, in certain circumstances (perhaps by inoculation), spread from the sick to the healthy.

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[1] *American Journal Med. Science,* May 1839.

[2] Bechtinger, *Ein Jahr auf den Sandwich-Inseln,* Vienna 1869, quoted by Lombard.

THE MARQUESAS ISLANDS, extending from 7° to 11° S. lat., belong to the French. They are free from malaria. *Typhoid Fever* is endemic in the group. *Scarlet Fever* and *Measles* are unknown. *Dysentery* is rare, but *Diarrhœa* is of frequent occurrence.

Bronchitis and *Emphysema* are very common. *Phthisis* is far from rare, but it is less frequent than in the Society Islands.

Muscular Rheumatism is of very frequent occurrence. *Scrofula* is not so common as in many of the Polynesian Islands, and *Syphilis* is rare.

Leprosy is very common. Clavel,[1] whose account of the pathology of this group I have followed, observed 18 lepers out of a population of 173 at the Bay of Anaiapa, in the island of Hiva-Oa; and in the Bay of Ananai, in the island of Ua-Una, he found 7 lepers among 28 inhabitants. This indicates that in certain localities, at least in these islands, leprosy is fearfully prevalent.

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[1] Clavel, *Archiv. de méd. nav.* vol. xliii.

AFRICA.

DIVISION I.

INTRODUCTORY.

Murchison compared Africa to an inverted basin. This does not, indeed, give a perfectly accurate description of the physical configuration of the continent, yet it emphasises one feature in its relief that has a marked influence on its pathology. The disposition of the mountains in coast ranges, rising to a higher altitude than the land in the interior, hinders ready drainage, and leads to conditions favourable to the development of malarious diseases. These ranges may be traced running parallel to the Mediterranean, through Morocco, Algeria, and Tripoli. Along the coasts of the Red Sea and of the Indian Ocean, at varying distances from the shore, more or less continuous ranges of hills are also met with, which are again to be traced along the west coast up to the north of Senegal, when a wide gap intervenes between the northern termination of the Senegambia range and the Atlas. As a result of this disposition of the hills, a great part of the interior of Africa, even when it is elevated, is only drained circuitously through the four great river systems, the Nile, the Niger, the Congo, and the Zambesi.

The interior may be divided (1) into certain areas of depression, (2) the great northern plain, (3) the southern plateau.

(1) Amongst the depressions the principal are the following:—(*a*) The Shott region at the foot of the Atlas, and inland from the Gulf of Cabes. (*b*) The Lybian depression, extending southwards through Tripoli and Barca for a distance of about 800 miles. (*c*) The great western depression of the Sahara, extending eastwards for nearly 1000 miles, from the shores of the North Atlantic to Tuat. (*d*) The depression of Lake Tchad in the central Soudan, at an elevation of 850 feet. These are all at low elevations. (*e*) The depressions met with at high altitudes, such as those of the central lakes, and that of Lake Ngami in the south. (2) The Soudan plain, continuous with the Sahara in the north, and extending south to

Adamawa, has a mean elevation of from 1000 to 1400 feet. (3) The central and southern plateau stretches from the table-land of Abyssinia in the east, Adamawa in the centre, and the Cameroons on the west, down to the southern extremity of the continent, with a mean altitude of 3500 feet.

The river systems are determined by the general configuration of the continent, and are in a marked degree associated with water-logging of extensive areas in the interior. Gordon has noticed a peculiarity about the Upper Nile and its tributaries that has an important bearing upon the health of the regions through which they flow. After quoting the remark of Murchison with which we opened this chapter, about the general configuration of the continent, he says that "the countries between the rivers have the same character. Along their banks is a ridge higher than the land in the interior; the consequence is, that the rain that falls cannot run off into the rivers, and so it rests and evaporates, making a malarious swamp." The Niger, again, follows a tortuous course, which sufficiently indicates that the configuration of the country is generally very unfavourable to rapid drainage. Crossing the range of hills in which the Senegal and Gambia rivers take their rise, we find the country sloping gently to the east or north-east towards the interior. The Niger, in fact, for the first 900 miles of its course, runs in a north-easterly direction towards the interior, before it makes its bend to the west and south. Here, then, is a shallow basin of vast extent from which ready outflow is impossible. In the same way the course of the Congo is very circuitous. The country through which the Upper Congo runs, from its source in Lake Bangweolo, through Lake Moero and the Manyuema, on to Stanley Falls, is one extensive marsh. The two great inland depressions occupied by the Ngami and Tchad are traversed by numerous rivers, which end in these lakes, and the countries through which they flow are frequently inundated. So is it with the basins of the Nyassa, Tanganyika, and Victoria Nyanza. Hemmed in by mountain ranges, these basins furnish conditions favourable to the stagnation of water in the soil. Nor is it otherwise with the inhabited parts of the Great Sahara. Here we find the various waddy or streams, some of them deserving the name of rivers, which descend from the southern slopes of the Atlas, pursuing their underground course, not to the sea, but to lose themselves in the arid sands, forming along their course oases and shotts that are humid and unhealthy.

The temperature, too, of this continent, except towards the extreme north and south, or where it is modified by altitude, is high, and in the equatorial regions, both along the shores and in many parts of the interior, the climate is marked by an excess of humidity.

The greater part of Africa thus presents all those peculiarities usually associated with the prevalence of endemic diseases. The higher table-lands, such as those of Abyssinia, those skirting the eastern and western shores of the lakes, the watershed between the Nile and the Congo, north-east of the Albert Nyanza, and especially the high lands lying south of the Zambesi, offer, both as regards temperature and soil, conditions more favourable to salubrity.

We shall now pass in review the different parts of Africa; and where we have no political divisions of a useful kind to follow,—and this is the case as regards the larger part of the continent,—we shall deal with the wider divisions determined by the physical features of the country.

CHAPTER I.

MOROCCO.

GEOGRAPHY AND CLIMATE.—Morocco is bounded on the west by the Atlantic, on the north by the Strait of Gibraltar, on the east by Algeria, and on the south by the Sahara. Its area is about 219,000 square miles, with a population of three or four millions. It is traversed from north-east to south-west by the Atlas ranges, which send out numerous spurs both towards the coasts and the Sahara, between and at the foot of which on the coasts many level and fertile tracts are met with.

The Muluya, and its tributary the Sharef, falls into the Mediterranean; the Kos, Oom-a-beg, Bu-Regreb, Tensift, Suse, and the Assaker, fall into the Atlantic.

The climate of the country lying between the Atlas and the sea is temperate, as it is freely exposed to the fresh sea breezes. The mean annual temperature of Tangier, opposite Gibraltar, is 64° F.; that of Mogador, on the Atlantic coast, is 70° F., with very slight variations in the different seasons. The rainy season begins about the middle of September. The climate of Tangier is very equable. The desert winds, so trying to the invalid in Algeria, are here little felt. Leared[1] formed a high opinion of the suitability of Tangier as a resort for invalids suffering from chest affections.

PATHOLOGY.—*Malaria.*—Morocco is only to a moderate extent malarious, in certain localities along the sea-coast, in some of the low valleys, and in certain of the towns, where pools of stagnant water abound. Intermittent fever is not unknown in Tangier, and the malarial cachexia is occasionally observed. According to Leared, intermittents are frequent in the city of Morocco; but the interior of the country, except in individual localities and in the extreme south, is generally remarkably free from malarious influences.

A medical man who visited Fez, Mequinez, and the city of Morocco, and who was consulted in hundreds of cases, states that he met with only one case of fever, and even in this case the disease does not appear to have been contracted in the country.[1] We gather from this writer that the towns are dirty, and bad smells meet one at every turn, but the smell of sewage is never observed. The Moorish towns, or many of them, possess a system of drains, and the water-supply is abundant. There is also no communication between the drains and the streets.

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[1] Leared, *Morocco and the Moors*, London 1876.

Typhoid Fever.—Typhoid fever is probably to be met with in Morocco as in Algeria, but we have met with no accounts of it; and it is not improbable that the drainage and good water-supply of some of the principal towns tend to restrict its prevalence. Lombard mentions *Typhus* and *Relapsing Fevers* as accompanying the famines which follow the flights of locusts.

Cholera was epidemic in Morocco in 1834, 1849, 1854, 1859, 1860, and 1866; but I am by no means certain that this is a complete list of its epidemic outbreaks in the country.

Dysentery and *Diarrhœa* are prevalent along the coasts. The writer to whom we have referred observes that the drinking water of Fez, derived from a river which flows past the town, almost invariably induces diarrhœa in strangers.

I have met with no accounts of the prevalence of the *eruptive class of fevers* in Morocco, except that smallpox leaves the marks of its presence on many of the population.

Respiratory Diseases are comparatively rare.

Phthisis is met with in the towns, although not frequently, but it is exceedingly rare in the country, and is seldom met with amongst the nomad Arabs in the interior.

Scrofula is not uncommon, while *Leprosy* is widely diffused in all parts of the country. Leared reports the existence of a leper village of about 200 inhabitants in the vicinity of the city of Morocco.

Rheumatism, of the acute articular kind, is rare in Morocco, but the chronic forms are common.

Syphilis is widely prevalent and malignant in type, as may be inferred from the number of persons met with who bear evident marks of the disease.

Ophthalmia is very prevalent in the country generally. At the capital it is said to be the exception to meet with a person free from the disease.

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[1] *Medical Times and Gazette*, July 28, 1877.

CHAPTER II.

ALGERIA.

Geography.—Algeria is bounded on the north by the Mediterranean, on the south by the Sahara, on the west by Morocco, and on the east by Tunis. Its area to the south is undefined, but it is generally estimated to cover about 173,000 square miles, with a population of above three and a half millions. It is divided into three provinces,—Algiers, Oran, and Constantine.

The country from the coast inland is marked off into three regions: (1) the Tell country, traversed by a series of hills called the Lesser Atlas, with fruitful, well-cultivated valleys and plains; (2) the mountainous table-land lying between the Great and Lesser Atlas, covered with numerous brackish lakes or shotts; (3) the Sahara, consisting mainly of sandy dunes, but diversified here and there by oases.

Climatology.—The mean temperature at Algiers is 18°·1; at Oran, 16°·9; and at Bone, 21°·74. These places are situated along the coast, but as we ascend into the interior the mean annual temperature becomes much lower, according to altitude. Thus at Aumale, at an elevation of 3100 feet, the mean annual temperature is 15°·1, while at Sétif, at an altitude of 3600 feet, it is 13°·5. The annual rainfall differs greatly in amount in different localities. At Oran it is 510 mm.; at Bougie, 1117 mm.; at Constantine, 696 mm.; at Philippeville, 789 mm.; at Biskra, 209 mm. The monthly mean temperature of Algiers will be given when we come to deal with the monthly distribution of fever mortality.

The seasons are divided as follows:—Autumn includes October, November, and the first part of December. This is the season when the rains begin to fall, and the torrents from the Atlas to inundate the plains. Winter extends from the latter part of December to the beginning of March. It is a period of rains and of low temperature. Spring begins in March and ends in June. During this season there are a few showers, the sky is clear, the vegetation magnificent. Summer includes July, August, and

September. When the harvest has been reaped the earth appears a desert.[1]

PATHOLOGY.—*Malaria.*—Although Algeria is much healthier at the present day than it was during the earlier years of the French occupation, endemic fevers are still frequent in numerous localities. The three provinces, Algiers, Oran, and Constantine, are unequally affected. Thus, in 1885, the admissions for malarial fever in the French army were, for the province of Algiers, 878 in an effective of 16,585; for the province of Oran, 1547 in an effective of 19,424; and for Constantine, 1388 in a strength of 17,155. There were 20 deaths from fever that year in all the three provinces. Including Tunis, there were 78 deaths from malarial cachexia, in addition to the 20 deaths from fever which occurred in Algeria.

Among the more malarious localities we may mention the plain of Mitidja. The subsoil of this locality is clayey, and presents depressions which retain the water descending from the hills. After the rains of winter, the low parts of the plain are covered with water to a sufficient depth to prevent telluric emanations; but, as the water evaporates, fevers appear in spring, increase in summer, and attain their maximum in autumn.[2] Bona or Bone on the coast was, when Audouard wrote, ravaged every year by fevers which he ascribed to the fact that half of its circumference was marshy. He observes that the barracks at Carobiers and at Fort Genois, situated like Bone on the coast, and at no great distance from that town, were healthy.[3] Haspel mentions the plain of Eghris as being marshy and malarious. Gigelly, a town surrounded by marshy country, was formerly excessively malarious.[4] Corre enumerates among the localities especially subject to endemic fevers, the plains of Zig and Habra and the borders of the Macta canal in the province of Oran; the plain of the Seybouse, the borders of the Fezzara Lake, and the valley of Soukna in the province of Constantine. The Lesser Sahara or plain of the Shotts, on the table-land of the Greater Atlas, is also feverish. Medeah, Miliana, Marabout, and Constantine, if not exempt, are only moderately malarious. Algiers, Koleah, Blidah, and Beni-Mered are comparatively healthy.

Colin states that in Algeria fever develops in the regions which seem to present conditions entirely opposite to those connected with a marsh—appearing in localities apparently the driest and the most sterile, having neither marsh, humidity, vegetation, nor vegetable decomposition.[1] Yet if we examine without bias the nature of the localities where endemic fever is most common, it will be seen that humidity, it may not be extreme nor always superficial, but comparative and sometimes deep, is more or less characteristic of them all. Here as elsewhere—here perhaps more than in many other places—marshes and a clayey bottom are favourable to the development of malaria. Armand, however, notices the existence of malaria at various places in the mountainous zones of the Lesser Atlas, where nothing of the nature of a marsh is to be found,[2] and such instances are not to be overlooked. We shall now inquire into the influence of temperature and rainfall on the prevalence of fever in Algeria.

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[1] Haspel, *Maladies de l'Algérie,* Paris 1850.

[2] Corre, *Maladies des pays chauds,* Paris 1887.

[3] Audouard, *De la periodicité des fièvres intermittentes,* Paris 1846.

[4] Corne, *Top. méd. de Gigelly,* Paris 1847, quoted by Lombard.

The subjoined table gives the monthly mean temperature and average rainfall of Algiers, along with the monthly distribution of 994 admissions and of 993 deaths, as quoted by Lombard on the authority of Laveran; and the monthly distribution per cent. of 427,468 cases admitted into the Military Hospitals of Algeria, for the years 1840–44 inclusive, as given by Armand:—

TEMPERATURE, RAINFALL, ADMISSIONS, AND DEATHS—ALGERIA.

Months.	Mean Temperature.	Rainfall.	Admissions (Laveran).	Deaths (Laveran).	Admissions (Armand).
January, .	11·61	142	54	98	5·7
February, .	12·67	126	40	65	4·7
March, .	13·30	83	41	64	5·0
April, . .	15·60	87	59	42	4·9
May, . .	19·60	55	58	35	5·3
June, . .	21·94	06	94	50	6·7
July, . .	24·00	00	141	83	12·3
August, .	24·72	08	114	100	14·3
September,	22·89	19	111	104	13·1
October, .	20·28	39	136	125	12·0
November,	16·51	129	88	121	8·8
December,	12·83	183	58	106	6·7

Although we have here the admissions and deaths from all diseases, the number of cases of fever, in proportion to those from all other causes, is so great that these figures give a fair idea of the monthly prevalence of malaria.

This will be seen by observing the quarterly distribution of diseases occurring in an effective of 1800 men. In the course of the year 1847, these furnished the following number of admissions into hospital :—

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[1] Colin, *Traité des fièvres intermittentes*, Paris 1870, p. 17.

[2] Armand, *Médecine et hygiène des pays chauds*, Paris n. d.

	Fever.	Wounds.	Venereal Affection.	Itch.
1st Quarter,	49	12	4	3
2nd ,,	60	18	8	...
3rd ,,	338	21	17	...
4th ,,	206	23	10	...

That is to say, the fevers are, or rather at that date were, to the other causes of disease in the proportion of 6 to 1. And the fever admissions of the 3rd quarter exceed those of the other three quarters combined.

Looking again at the table, it appears that the number of admissions begin to diminish considerably in November, when the heavy rains commence, and continue to diminish until February or March, when they attain their minimum. By March the rains have begun to moderate, and with the constantly diminishing rainfall and augmenting temperature of April, May, and June, fevers do not increase to any extent. It is only in July, a month when no rain falls, and when the temperature has nearly attained its maximum, that the first great increase in fever prevalence occurs. According to Laveran's statistics, fever attains its maximum prevalence in July; according to those of Armand, the maximum is in August. The exact period probably varies somewhat in different localities and years. Corne's observations at Gigelly, in 1842, of the admissions and deaths upon an effective of 800 men, from July to October, seem to point to July as the most unhealthy month; but then it must not be forgotten that Gigelly is extremely malarious, a circumstance which may cause the period to anticipate somewhat. The following are the figures :—

	Admissions.	Deaths.
July, ...	686	17
August, ...	507	9
September, . . .	307	4
October, ...	270	9

Of one thing we can be certain, viz. that July, August, September, and October, which are dry and warm months, are the months during which fever is most prevalent. It is not here as in India, the drying-up months, with a falling temperature, that are most unhealthy; nor as in Rome, where Colin observed an increase of fever to follow each of the early rains at the end of summer. In Algeria no such explanations of the sudden and excessive outburst of fever are admissible, for here July is rainless. Nor does fever in Algeria follow the inundations as in Sind, nor accompany them as in Senegal, but may be said to precede them. Each observer is naturally inclined to trace a causal relation between the fever period and the meteorological phenomena with which such period is associated in his own special field of observation. Facts like those to which we have referred show how important it is not to be in a hurry to draw general inferences from the apparent relations between fever and meteorological phenomena as met with in one or two countries.

In Algeria, numerous instances are recorded of outbreaks of fever following the clearing or breaking-up of the soil.

Armand himself, the vigorous opponent of all doctrines of infection and of intoxication, quotes an instance illustrating the influence of irrigation in determining a notable increase of fever (p. 152).

The fevers met with in Algeria are of the intermittent, remittent, or pseudo-continued form, all of which may be simple or complicated with diarrhœa or dysentery, etc. Pernicious attacks are not uncommon. The remittent form constitutes about 16 per cent. of the total; but in the worst fever localities it bears a higher proportion. At Gigelly, for example, remittent fever, simple and complicated, formed 85 per cent. of the cases. At Bone, Maillot found the types of 2338 cases of intermittent fever to be:

Quotidian, ...	1582
Tertian, ...	730
Quartan, ...	26

Spring fevers are mild; they are frankly intermittent, with the three stages well marked, tending to undergo a spontaneous cure in the 2nd, 3rd, 4th, or 7th paroxysm. Almost all who have spring fevers have already suffered from fever during the previous autumn. The summer fevers are more violent, their stages less distinct, tending to assume more of a remittent or a pseudo-continued form, with gastro-intestinal complications. It is in the first half of the autumn season (October, November) that malaria seems to attain its greatest intensity, judging by the number of deaths over a series of years. Bilious complications are at this season rather prevalent, with enlargement of the spleen, and with well-marked malarial cachexia (Haspel).

Pernicious attacks — algid, comatose, delirious, choleraic, and dysenteric—are met with not unfrequently. Of 39 cases of this nature recorded by Maillot, I find that 20 occurred in the three months, July, August, and September. This authority states that the pernicious attack supervenes most frequently from the 3rd to the 6th paroxysm of the quotidian type; from the 3rd to the 4th paroxysm of the tertian type; and from the 4th to the 8th day in the pseudo-continued form.

Typhoid Fever was formerly thought to be rare in Algeria, except amongst the young soldiers recently arrived from France. This may have been the case as regards the past; but at the present day it is of excessively frequent occurrence amongst the civil population in all the cities and towns for which we have returns. In 1887, the typhoid death-rate in nine towns, having an aggregate population of 322,880, was 1341 per million; and in 1888, the mortality in thirteen towns, with an aggregate population of 382,033, was in the ratio of 1078 per million. As the death-rate from this disease in the large towns of France is 593 per million, it is evident that typhoid fever is much more prevalent in Algeria than in the mother country.

In the period 1875–79, the deaths from typhoid fever among the troops stationed in Algeria averaged 5 per 1000—a proportion in excess of that which was observed at any of the stations occupied by the French army, with the exception of Marseilles. (See Table, p. 175.)

Typhoid fever is more prevalent in the provinces of Algiers and Oran than in Constantine.

Typhus Fever is rarely seen in Algeria, although Hirsch conjectures that it is endemic in Kabylia, becoming epidemic from time to time.

Relapsing Fever appears to have been observed along with typhus during the famine of 1867.

Diphtheria and *Croup* cause a great mortality in Algeria. The death-rate in 1887 was 1393, and in 1888 it was 1552, per million. The mortality from these diseases in France is 637 per million, and this is high compared to that of England.

Cholera was introduced into Algeria by troops from Europe in 1834–35, 1837, 1859–60, and 1865, and by a pilgrim vessel from Malta in 1850. It has also been epidemic on other occasions on which the manner of its introduction is uncertain, as in 1854–55. It has generally been observed to subside in a very marked manner during the heavy rains of November and December, to re-appear in an epidemic form in the following spring or early summer, as in 1834–35, 1850–51, 1854–55, 1859–60, and again in 1865–66 (*Trans. Epidem. Soc.* vol. iii.).

Diarrhœa and *Gastro-Enteritis* give rise to a great mortality. In 1887, this class of diseases caused a mortality of 2481, and in 1888 of 2968, per million. The town of Constantine has a lower death-rate from diarrhœa than Algiers or Oran.

Dysentery is one of the most fatal diseases of the country, being specially prevalent in the province of Oran. The excess of dysentery in the province of Oran, as compared with the province of Algiers, is ascribed to the large amount of the sulphates of soda and magnesia along with carbonate of soda in the drinking water of the former, which is replaced by carbonate of lime in the water of Algiers. The acute disease is most common during the warm season, the chronic form during the cold months. It frequently occurs as a complication of malarial fever.

Smallpox and *Measles* appear in an epidemic form from time to time, and cause a very considerable mortality. Thus, in 1888, no fewer than 748 deaths are ascribed to smallpox, and 260 to measles, in the town of Oran, with a population of 68,149.

Scarlet Fever does not appear to be prevalent.

Acute and *Chronic Bronchitis.*—Contrary to what might have been expected, bronchitis is to be regarded as one of the more fatal diseases of Algeria. The death-rate from the two forms of the disease in the towns was 2648 per million in 1887, and 2156 in 1888. In the latter year the acute form caused a ratio of 1104, and the chronic of 1052, deaths per million. The ages from 20 to 60 suffer little from bronchitis, which is most fatal in infancy and old age. According to Lombard, pneumonia, pleurisy, bronchitis, and laryngitis form 108·5 per 1000 of the total diseases in the army in France, whereas in Algeria they form only 56·3 per 1000; from which he concludes that the climate of Algeria reduces by half the frequency of acute thoracic inflammations. This comparative immunity of the military from acute chest affections is remarkable; but it will be evident that bronchitis is far from rare among the civil population in Algeria, if we remember that the death-rate from bronchitis in England, in 1884, was 1971 per million living.

Pneumonia and *Broncho-pneumonia* together caused a death-rate of 2409 per million in 1887, and of 2751 in 1888. These proportions, again, are much in excess of those observed in France or England. In the latter of these years no fewer than 1051 deaths were registered from these diseases in the thirteen towns for which we have statistics, with a population of 382,033. The total diseases of the respiratory system caused in England, during the ten years ending 1880, a mortality of 3760 per million, and in London one of 4600 per million, whereas bronchitis and pneumonia gave rise in 1888, in the Algerian towns, to a death-rate of 4907 per million. These facts seem to show beyond doubt, and contrary to what is generally believed, that acute diseases of the bronchial tubes and of the lungs are excessively fatal in Algeria.

Phthisis causes a high mortality in Algeria, but this is owing to the large number of invalids who resort thither, on account of the reputation it enjoys as a climate peculiarly suited to this disease. The death-rate from phthisis in 1887 was 3097 per million in nine large towns, and in 1888 it was 2761 per million in thirteen towns. When, however, we come to examine the figures, this high mortality is seen to be due to an excessive death-rate in certain towns, whereas that of the country generally is low. This will be apparent from the following table, which gives the death-rate per million in ten of the largest towns in the three provinces:—

Town.	Population.	Number of Deaths.	Ratio of Deaths per Million living.
Algiers,	75,432	234	3,102
Oran,	68,149	195	2,861
Constantine,	44,960	42	934
Philippeville,	22,177	23	1,037
Bone,	29,640	16	540
Sidi-bel Abbès,	21,124	27	1,278
Mustapha,	17,729	302	17,034
Blida,	24,304	83	3,415
Mascara,	15,453	21	1,359
Tlemcen,	26,695	34	1,273

In the four towns, Algiers, Oran, Blida, and above all in Mustapha, the deaths are excessive; in all the others phthisis causes a low mortality. We may conclude, therefore, that Algeria, as a whole, is remarkably free from phthisis, which, however, is more prevalent in the towns than in the country, and that the high death-rate of some localities is largely due to patients from other countries. The disease is said to be rare among the Arabs, and somewhat more frequent among Negroes, but much more common among the half-castes arising from the mixture of these races.

Diseases of the Liver are of somewhat frequent occurrence in Algeria. Acute and chronic hepatitis and abscess of the liver, the latter often appearing as a sequel of dysentery or of ulcerative enteritis, are the forms most frequently observed. *Jaundice,* according to Lombard, is much more rare in Algeria than in France.

Leprosy is widely diffused throughout the country, both on the coast and in the interior, especially among the Berbers or Kabyles. It is met with even in the oases of the desert, where one may suppose that fish is not a common article of diet.

The *Aleppo Boil,* known here as the "bouton de Biskra," from the town of that name in the interior, is very common throughout the Algerian Sahara.

Goitre is met with on the slopes of the Atlas.

Syphilis is less frequent among the troops stationed in Algeria than amongst those stationed in France.

Acute Articular Rheumatism is not of frequent occurrence.

CHAPTER III.

TUNIS AND TRIPOLI.

Tunis, to the east of Algeria, is traversed by a continuation of the Atlas mountains. The northern coast is rocky and steep; the eastern coast, on the other hand, along the Gulfs of Hammamet and Cabes, is flat, sandy, and barren, the brooks generally losing themselves in the sand.

Some districts of Tunis are equally fertile with the Tell country of Algeria, but much of the country is unfit for cultivation.

Pathology.—*Malaria* reigns all along the Tunisian coasts, from La Goulette to Zarzis. The plain of Carthage is malarious, and many *savants* have died of pernicious attacks while making excavations there.

All the plain which separates Bou-Chateur from the sea is marshy and malarious. At Porto Farina malaria is rare. The coast from Kalibia to Souse is relatively healthy. The town of Tunis is situated on the northern slope of the hill named Sidi-Ali-el-Hattab, between the lake of Melah to the south-east and Lake Boghaz to the north-east, both of which are regarded as foci of malarious emanations. The town is unhealthy. In 1863 an epidemy of malaria prevailed not only in the town itself, but over a large extent of the country, attaining its maximum in August. The malarial cachexia develops very rapidly in this locality. (Mestre, quoted by Rey.)

Sfax is malarious, the remittent form being the most common, inducing cachexia. At Cabes, intermittent of the quotidian and tertian types, remittent, bilious remittent, and typhoid forms, are all met with. The neighbourhood of the Oued, the bed of which is almost dry in summer, leaves exposed a great quantity of mud. This, and an extensive sheet of water under the surface, to which Cabes owes its fertility, may account for the unhealthiness of this locality.[1]

The environs of the lake of Bizerta, on the north coast, are said not to be malarious; the soil around it is light and sandy, and the lake does not dry up and leave marshy ground exposed. Lake Mateur, on the other hand, is brackish, and leaves exposed at times malarious foci of some intensity.

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[1] Tissot, *Arch. de méd. nav.* 1888.

Hirsch states, on the authority of Farini, that pernicious endemic fever prevails in Tunis as in Tripoli, near to the salt lakes and oases. Such salt lakes exist to the west of Cabes.

The fever season in Tunis extends from June to October.

Cholera.—Tunis was visited by cholera in 1835, 1850, 1856, and 1867.

The only locality in Tunis respecting which we have any detailed information is the seaport town of Bizerta; and as it is probable that the pathology of this locality does not differ very materially from that of the country generally, we shall give a *resumé* of what Fricourt[1] relates of the diseases prevailing in this town.

Typhoid Fever in a sporadic form is met with. (In Tunis it often begins with a temperature of 40° C., Tissot.)

Diphtheria is rather common.

Smallpox, unless when it breaks out as an epidemy, is excessively rare.

Measles and *Scarlet Fever* are far from frequent.

Dysentery and *Diarrhœa* prevail extensively, as they do along the whole coast, from July to October. *Diseases of the Liver* are by no means frequent.

Phthisis is seen both among the natives and Europeans, but it is probably less common than in Europe.

Pneumonia, Pleurisy, and *Bronchitis* are said to be seldom met with.

Rheumatism, acute and chronic, is excessively frequent, both among Europeans and natives, forming about a third of the diseases treated.

Syphilis is very destructive to the Arab population; and *Leprosy* is endemic in Tunis generally. In Bizerta, with a population of 6000 souls, there are some eight or ten lepers.

TRIPOLI, including BARCA, is bounded on the west by Tunis, on the east by Egypt, on the north by the Mediterranean, and on the south by the Libyan desert. The Atlas here terminates its eastern course, leaving the country exposed to the hot winds of the desert. Tripoli is destitute of rivers, and rain seldom falls; but the dew, which is copious, suffices to support vegetation in some favoured districts.

I have met with no precise accounts of the existence of endemic fever, typhoid fever, or dysentery in this country. Tripoli is not exempt from typhus, and has been visited by the plague.

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[1] *Archiv. de méd. nav.* 1884.

The latest outbreaks of the plague on the Mediterranean coasts of Africa have occurred in Tripoli. It appeared in April 1858 at Benghazi, a port of Tripoli, spread over the province, and died out in June of 1859. The last outbreak occurred in April 1874, was limited to a few tribes of Arabs inhabiting the Cyrenaic plateau, and ended in July of the same year (Hirsch). Tripoli escaped cholera in 1831, 1837, and 1848, when it was epidemic in Egypt. In 1850 the disease was introduced from Tunis, and it was again attacked in 1853 and 1855.

CHAPTER IV.

EGYPT AND THE WESTERN COASTS OF THE RED SEA.

Geography and Climate.—Egypt extends from the Mediterranean up the Nile valley to Assouan in 25° 5′ N. lat., and from the Libyan desert on the west to the Red Sea. The population numbers about seven millions. The distinguishing feature of Egypt is the Nile, which alone renders it habitable. The country is almost rainless, and cultivation extends only to the limits of the annual inundation.

The Nile commences to rise about the 10th of June. At first it is green with the vegetable *débris* from the lagoons on its upper course. In July it becomes red with the waters from the Abyssinian high lands. Towards the end of August it is nearly full, but continues to increase slightly till the 7th of Ocober, when it usually reaches its highest point. From this date it begins to subside. In November the lands have dried sufficiently to permit their being sown. The harvest is gathered in March.

The district of Fayoum, in the north, forms a depressed basin 30 miles in extent from north to south, and 40 miles from east to west. It is connected with the Nile by a narrow valley.

Climatology.—The climate of Egypt is mild, and above Cairo it is remarkably dry. In the delta the air is more humid. As we ascend the Nile, the temperature increases. At Keneh the mean temperature of the year is 4°·2 C. higher than at Cairo; and at Wady Halfa the summer heat is still more intense. At Kosseir, on the Red Sea, the annual mean temperature is 24°·6 C.

The following are the monthly temperatures of Alexandria and Cairo:—

	Alexandria.[1]	Cairo.[2]		Alexandria.	Cairo.
	°	°		°	°
January, . .	14·3	12·9	July, . . .	25·8	28·9
February, . .	14·3	14·6	August, . .	26·8	27·9
March, . .	16·7	16·1	September, . .	25·6	25·0
April, . .	19·4	20·5	October, . .	24·8	22·8
May, . . .	21·3	23·2	November, . .	20·3	18·8
June, . . .	24·2	28·5	December, . .	15·8	15·1

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[1] Alexandria has an annual rainfall of 7·75 inches, the rainy season being from November to January or February.

[2] The rainfall of Cairo is entirely insignificant.

PATHOLOGY.—*Malaria.*—The following table, which gives the mean death-rate from pernicious and malarial fevers per 1000 of the inhabitants in various places in Lower and Upper Egypt for the two years 1887 and 1888, is intended to illustrate the distribution of malaria in Egypt:[1]—

LOWER EGYPT.		UPPER EGYPT.	
Cairo,	0·42	Fayoum,	1·29
Alexandria,	1·48	Benisooef,	0·39
Damietta,	0·10	Minieh,	0·54
Tanti,	0·15	Siout,	0·68
Mehall-el-Kebir,	0·15	Mellawi and Manfalout,	1·13
Mansourah,	0·17	Sohag,	none
Damanhour,	0·19	Keneh,	3·13
Zagazig,	0·42	Esneh,	1·33
Rosetta,	0·18	Akhanin and Tahta,	0·20
Chibin-el-Kom,	1 case in 2 years	Assouan,	0·54
Guizeh,	0·48		
Benha,	1·98		
Five other towns,[2]	0·54		
Port Said,	1 case in 2 years		
Suez and Ismailia,	4·75		
Average of Lower Egypt,	0·67	Average of Upper Egypt,	0·94

The high fever death-rate of Suez arises from conditions to which we shall presently refer. The mortality from malarial fevers in Upper Egypt is higher than in Lower Egypt. Both in Upper and Lower Egypt the greatest fever mortality falls on the autumn season—October to December.

A better means of appreciating the prevalence of malaria in Egypt than that to be obtained from a consideration of the fever death-rate, is afforded by the results of the late campaigns, as nothing brings out the malarious elements of a climate more readily than a campaign in which European troops are employed. From July 17 to October 9, 1882, the admissions among the troops from ague and remittent fever were 17·7 per 1000. Five deaths from remittent fever took place, and 57 cases were invalided. It must not be forgotten that some of the troops had already served in fever countries. This does not look like the history of a campaign in a malarious climate. In 1885, the admissions in the Nile Expeditionary Force from paroxysmal fevers were only 5·7 per 1000. Of 61 admissions, 49 were for ague, and 12 for remittent fever. In 1884, the admission-rate from paroxysmal fever was 20·6 per 1000, and in 1885 it was 32·2 per 1000. As regards the higher rate for 1885, it is stated that the 2nd Battalion of the Sussex Regiment, stationed at Suez, suffered severely from ague and remittent fever, both while it was stationed at that place, and also after it had been transferred to Cairo. The camp at Suez is very low-lying, water being obtainable two feet from the surface ; and the whole land in the vicinity is wet, on account of irrigation and percolation from the fresh-water canal, which passes close by. The inhabitants of Suez suffer from these fevers every autumn.[1]

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[1] *Bulletin Hebdomadaire*, 1887–88.

[2] Samanoud, Mit-Gamr, Kafr-el-Zaiat, Menouf, and Bilbeis.

At Ismailia, on the Suez Canal, fevers became so numerous in 1880 as to demoralise the population. It was observed that the recrudescence coincided with the predominance of N.N.E., N.E., or E.N.E. winds, which had become more continuous for some years previously, and that these winds passed over a marsh behind the water-works. The marsh was dried, and the fever disappeared.[2]

Red Sea.—Kosseir, in 26° 7′ N. lat., is stated not to suffer much from fever, and Suakim is only moderately affected. In 1885, the admissions at Suakim were 49·4 per 1000 from remittent and intermittent fevers. In a previous report it is remarked that the Indian troops were the chief sufferers. Condensed water was used by all alike. The reason why the Indians suffered most was, no doubt, that they had already contracted the disease in their native country.

H.M. ship *Sphinx*, lying in the harbour of Suakim, had no case of fever until the end of May, when one case occurred. About the beginning of June the water in the harbour fell considerably, exposing the reefs of coral, as well as a low spit of land, close to the ship, on which some mangrove bushes grew, and which had before been completely covered with water. Ten cases of fever suddenly occurred within five days. The fever declined when the water rose.[3]

The medical officer of the *Carysfoot* describes the Suakim fever thus :—"It was characterised by great and profound nervous depression, headache, pain in back and loins, and general *malaise*. Sometimes it was complicated with symptoms of articular rheumatism ; this last being always present in patients who were attacked after exposure to night air."

The experience of the Abyssinian Expedition [4] seems to show that

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[1] In the same way, of 119 cases of ague treated in 1887, no fewer than 104 occurred at Alexandria, and all but 3 in men belonging to the 1st Yorkshire Regiment, and were for the most part contracted at Mex, which during southerly winds is exposed to the malarious emanations of Lake Mariotis, as it dries up on the subsidence of the Nile ; 92 of the cases occurred in the months of October, November, and December.—*Army Medical Report*, 1887.

[2] Fricourt, *Archiv. de méd. nav.* 1884.

[3] *Stat. Rep. Navy*, 1884.

[4] Currie, *Army Medical Report*, 1867.

Zoolla, in lat. 15° 15′, is comparatively non-malarious. Massowah is said to be adversely affected from the same cause as that noted at Suakim, viz. by the sea leaving lands exposed which give off fœtid emanations.

The Dahlak and Nokara Islands, according to Aubert-Roche, are healthy. Edd is reported to be healthy, but Berbera and Tejureh are not free from fever.

From what we have seen, Egypt as a whole, and even the Egyptian coasts of the Red Sea, are only slightly subjected to malarious influences, although individual localities, such as Suez, suffer very considerably. One cannot help contrasting in this respect the valley of the Indus with that of the Nile. Both are dry regions subject to inundation. The admission-rate from paroxysmal fevers at Hyderabad, in Sind, is 858 per 1000; that of Egypt is 32 per 1000. Is this difference entirely owing to the lower mean temperature and lower daily range in Egypt?

Dr. Esclangon gives us an account of the diseases prevalent in the French settlement of Obok, at the Strait of Bab-el-Mandeb. The endemic fever observed here is thought by this author to be neither malarious nor typhoid in its nature, but to be of climatic origin. Its onset is sudden, generally without rigors; the skin is dry and burning, with great pain in back and loins, and frontal headache. Constipation is the rule; diarrhœa and vomiting are exceptional. In many cases the disease is ephemeral; in cases of medium gravity it lasts from six to nine days; while in the gravest forms it continues for twenty or thirty days. When it is tending to a fatal termination, the temperature oscillates about 40°; there is sleeplessness, quiet delirium, subsultus, small pulse, and slowing of the heart's action. There is no meteorism, skin eruption, nor pain in the iliac region. We have here probably to do with simple continued fever and tropical typhoid.

Typhoid Fever is endemic in Egypt. The average admission and death-rates of the troops for 1887–88 were 29·2 and 6·5 respectively. Nor does the disease appear to be rare among the native population. Hunter states that typhoid and gastric fevers accounted for 7 per cent. of the deaths occurring at Cairo in 1881, and for 10 per cent. of the mortality in 1882.[1] The months of its maximum prevalence are September to November. Squire met with typical cases of enteric fever at Suakim, and with other cases which he calls typho-malarial, characterised by general congestion and ecchymosis of the intestinal mucous membrane.[2]

Typhus Fever is frequently met with in a few scattered cases.

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[1] *Trans. Epidem. Soc.* 1883–84.

[2] *Ibid.* 1887.

and at intervals in more extended outbreaks. It is doubtful whether it is endemic in Egypt proper; it is more probable that it is introduced from Nubia, where it is endemic. In 1881 and 1882 there were 35 and 46 deaths respectively registered from typhus at Cairo; and Hunter states that it prevailed to some extent in the villages of the delta in 1883.[1]

Relapsing Fever, in the form known as bilious remittent, is endemic in Egypt and Nubia.

Simple Continued Fever is rather common among the British troops. It is remarked that this fever, the nature of which is still an open question, increases in prevalence with the rise of the Nile. It is believed to be influenced, if not caused, by local insanitary conditions, intensified by the rise in the river, being especially common in those localities where the rise induces a marshy state of the soil.[2]

Plague, which was endemic on the Nile from remote antiquity, made its last appearance in 1844. From a table given by Hirsch, founded upon 12,282 deaths occurring in Alexandria between 1834 and 1843, we learn that plague attained its maximum fatality in March (4952 cases) and April (2936 cases), and its minimum in September (15 cases) and October (18 cases).

Cholera.—Egypt has been visited by cholera in 1831, 1848, 1850, 1855, 1865, and 1883–84. The disease is believed to have been introduced from Arabia in 1831, 1848, and 1865; from Tunis in 1851; and from Turkey in 1855. All the epidemies have broken out between the 4th of June and the 25th of July, that is, during the dry and hot season; but the time of its appearance in Egypt may have been regulated more by the period of the Arabian festivals than by the climatic conditions prevailing in Egypt itself.[3]

Dysentery ranks as one of the most fatal diseases of Egypt, affecting alike the natives and the Europeans resident in the country. The average admission-rate of the English troops, for the three years 1886–88, was 56·5, and the death-rate 2·42, per 1000. In rather more than half of the autopsies performed by Griesinger, dysenteric lesions were found. According to Dikaios, dysentery is more grave in Middle and Upper Egypt than on the coast.[4] At Cairo, according to Hunter, dysentery gave rise to 12·9 per cent. of the total mortality in 1881, and to nearly 14 per cent. in 1882;

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[1] *Trans. Epidem. Soc.* 1884.

[2] *Army Medical Report*, 1887.

[3] *Trans. Epidem. Soc.* vol. iii.

[4] *Des maladies prédominantes dans la colonie grecque d'Alexandrie*, Paris 1862, quoted by Lombard.

while gastric catarrh occasioned 13·3 and 15 per cent. of the deaths in these two years respectively.

The eruptive fevers are met with in Egypt as elsewhere. *Small-pox* breaks out in an epidemic form from time to time. It becomes more prevalent as we ascend the Nile towards Nubia, where the disease is endemic. *Measles* and *Scarlet Fever* are moderately common.

Respiratory Diseases furnish an admission-rate of about 29·5 per 1000, and a death-rate of 1·0 per 1000 of the mean strength of the English troops occupying Egypt—a proportion which goes to confirm the generally received opinion that this class of diseases is rare in Egypt.

Phthisis does not prevail extensively in any part of the country, but it is more frequent near the shores of the Mediterranean and at Cairo than in Middle and Upper Egypt, where it is very rare. At Suakim, on the other hand, it was observed to make rapid progress among those in whom it developed.[1] Tuberculosis is said to be common at Obok.

Hepatitis and *Abscess of the Liver* are met with not unfrequently; but I do not gather from the health reports of the army that they are so common as in many warm countries. It is reported to be somewhat common in Cairo and in Central and Upper Egypt. The male sex, and those who make use of spirits, are most liable to suffer from these affections.

Rheumatism.—At Cairo acute rheumatism is very common, both among the natives and Europeans. In 1885, a ratio of 42 per 1000 of the English troops was treated in hospital for rheumatism, one-third of the cases being of the acute form.

Venereal Diseases of all kinds are common. The troops, which are chiefly stationed at Alexandria and Cairo, suffer from these diseases to even a greater extent than at home. No part of the country, and none of the races which inhabit it, escape the disease, which, however, is said to be of a rather mild type.[2]

Scrofula is frequent among the fellahs and negroes.

Leprosy is met with in all parts of the country, especially in Upper Egypt. In ancient times Egypt was looked upon as the peculiar endemic seat of this disease.

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[1] *Army Medical Report*, 1884.

[2] Jullien, *Archiv. de méd. nav.* vol. xxx.

CHAPTER V.

THE SAHARA.

GEOGRAPHY AND CLIMATE.—The Sahara may be divided into three parts,—the Northern, the Central, and the Southern.

The Northern Sahara stretches from the southern slopes of the Atlas in Morocco, Algeria, and Tripoli (including Tuat in Morocco, the Algerian Sahara, Fezzan, and the Libyan desert). This is the region of underground rivers, oases, and salt lakes. Some of the underground rivers are of great length, and have numerous tributaries.[1] "The Wed Djidi or Mzi has a course of 400 miles from the Atlas, until its termination in Shott Melr'hir, between Tuggart and Wed Souf. The Wed n'ça, like the Djidi, runs mostly underground, but has a shorter course. On the Wed m'Zab stands Ghardia and four other cities, and its oases support many thousand inhabitants. Farther south is the Wed el-mia, said to receive a hundred tributaries, on one of which stands the city of Metlili, and on another the Touareg post of Golea. This river can scarcely be traced after it passes the vast oasis of Waregla (Ouargla), unless, indeed, it finds an underground passage to the Wed R'hir, of which, however, there are no external traces."

The Shott Melr'hir, though fed by so many streams, is generally dry for seven months in the year, and yet it is the lowest depression in the whole of North Africa. "It is difficult to trace its precise limits, but a depression of the average breadth of 30 miles extends from El Marier to the north of the Wed R'hir as far as the Gulf of Cabes."

The lake of Tuggart is marshy. Numerous other marshy shotts are met with in the eastern part of the country. At Wed R'hir, where there is neither stream nor river, and but two or three natural springs, there is everywhere beneath the surface a thin stratum of water. Barren sands traversed by underground streams, subterranean sheets of water, oases, and shotts, are the features of the country which seem of most importance from a medical point of view.

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[1] Tristram, *The Great Sahara*, London 1860.

The shotts and the oases probably owe their existence to an impermeable subsoil which retains the water in depressions, and prevents its percolation or ready outflow or onflow. How else can we account for the existence of these lakes, or for the retention of moisture sufficient to form an oasis?

The climate of the Sahara is temperate in winter, but very hot in summer, the difference between the day and night being excessive. Largeau found the thermometer in January to mark 35° in the shade, and to fall at night to –4° C. In July it was observed to reach 55°·1 in the shade, and descend at night to 29°.

The mean temperature at Laghouat, 180 metres above the sea-level, is as follows:—

January.	April.	July.	October.	Year.
6·9	15·2	28·8	16·5	16·9

PATHOLOGY.—Many of the oases situated on the streams we have mentioned are unhealthy.

"About the middle of April," Tristram says, "and at the commencement of autumn, the fever breaks out in its most malignant form at Wed R'hir. No stranger dares, at these epochs, to venture south of Biskra. The very nomads quit the country. All who are not swarthy Rouara, whether Jews, Arabs of the Sahara, Mozabites, or natives of Souf, fly precipitately as soon as the ditches become of a reddish tint and the mosquitoes begin to appear. No strangers except the negro or half negro of Tuat can survive. Even the aborigines do not escape unscathed, for although with them the 'Oukheum' or fever is not generally fatal, the villages swarm with wretched objects, worn down to the last stage of attenuation, as if by repeated attacks of ague." Although the fever is usually intermittent, in some cases it is continuous. The temperature in this form is not so high, and the symptoms are less intense, but it is more apt to become chronic and is difficult to shake off; the patient often carries it with him until the end of his miserable existence.[1] In the Sahara, according to the Arab proverb, "He who is not reaped by the sword sees days without end;" or, according to the Frenchman, "In the Sahara we have health, but must perish of thirst; in the oases we have water to repletion, but must rot of fever."

The oases of Tuggart and Laghouat (El Agouat) are known to be highly malarious. The vast oasis of Waregla (Ouargla) is notably unhealthy. The natives blame the water, and recommend that it should not be used until it has been left over a night to cool. The water, however, is probably pretty much the same in different seasons of the year, but the fevers occur chiefly in spring and autumn. It is certainly remarkable that dysentery is not endemic in this locality, where malaria is so prevalent and the water so bad.

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[1] Largeau, *Le pays de Rirha Ouargla*, Paris 1879.

Respecting Fezzan, I can add nothing to the statement of Hirsch—that "this basin-shaped province, abounding in salt lakes, is the seat of pernicious endemic malarial fevers." At Mourzouk, the capital, in 26° N. lat., the temperature in December and January is 5° 5′; while in the desert in the sun the thermometer placed in the sand rises to 60° C.

The oasis of Siwah in Libya, which is marshy, and the climate characterised by great vicissitudes, is very unhealthy. Respecting the other oases in this part of the Sahara I have no information.

All the oases of the Sahara are not, however, unhealthy. Ghadames, in lat. 30° 9′ N. and long. 9° 17′ E., has a hot dry climate, of great extremes, but is reputed to be non-malarious.

The Central Sahara, to the south of the region just described, is a dreary, desolate region, traversed only by nomad tribes. The general opinion is that this region is free from malarious diseases. This is supported by the opinion of the Arabs themselves, which finds expression in the proverb quoted above. Borius states that in the Sahara there is no fever except in the oases. The experience of the British troops in the marches through the Egyptian desert for the relief of Gordon, tends to confirm this view of the non-malarious character of the sandy, waterless tracts, notwithstanding the intense solar heat and great vicissitudes of temperature.

To the south of the central desert lies a tract, the limits of which are not well defined, which, although in great part sandy and barren, is not entirely destitute of water. On the west is the Aderer country, with the towns of Wadan and Atar. During January, Panet observed the temperature to fall to 4° C. at 6 o'clock in the morning. Vincent observed the thermometer to rise to 47° 5′ at 2 o'clock in the afternoon in May. I have met with no very precise accounts of the health of this region. Mungo Park found intermittent fever and dysentery to prevail in the Ludamur country, to the south of Aderer, a region generally sandy, with a very scanty water-supply.

Consumption is exceedingly rare in the Sahara.

CHAPTER VI.

SENEGAL.

GEOGRAPHY.—Senegal has been ably and exhaustively treated by Borius, in a series of papers appearing from time to time in the *Archives de médecine navale.* Perhaps it is not going too far to say that no other considerable portion of the earth's surface has been more thoroughly considered in its medical aspects.

Taking advantage of his researches, and making a free use of his tables, we shall deal somewhat more in detail with the endemic diseases of Senegambia than with those of most other regions of continental Africa.

The Senegal river rises in Mount Cooro, in lat. 10° 30′ N. and long. 10° 40′ W. It flows first to the north and then to the west, to fall into the sea at St. Louis. Along its banks are situated from the coast inland the following stations, viz. St. Louis, Dagana, Podor, Matam, Bakel, and Medine.

This river is subject to a regular annual flood, which inundates the low country through which it flows. The inundation begins in June and ends in November, attaining its maximum in September. As illustrating the conditions resulting from the inundation, Borius instances the post of Dagana near the coast. Here, at the end of September, the fort is one mètre above the level of the water which encircles it. The houses of commerce are equally surrounded with water, and separated from each other by streets which now serve as canals, communicating between the water of the river and that which has invaded and converted into a great lake the vast plain situated to the east of the fort. In the month of March, on the other hand, the soil is dried up, covered with profound and dangerous fissures, and supporting only a stunted vegetation. Here and there, one still meets with depressions containing stagnant water. It is at the moment when the water retires that the natives sow their crops, and three months later they reap the harvest. It need scarcely be said that, apart from the flooding of this country by the overflow of the river, the rainfall during the season suffices to render many districts marshy which are not liable to be inundated by the river. Besides those stations which we have mentioned, following the course of the river into the interior, the French occupy the small island of Goree, south-east of Cape Verd and close to the mainland. On the mainland, and in Senegal proper, we meet with Dakar in lat. 14° 40′ N., Mbidjem at a distance of 36 miles from Goree, Sedhion close to the right bank of the Casamanza, and Boké in lat. 10° 53′, on the river Nunez—both the latter being south of the Gambia. The English have settlements on the River Gambia and its neighbourhood.

We shall give a few notes on the climate and topography of some of the stations, to which we shall have again to refer.

St. Louis is situated at the mouth of the Senegal river on a low sandy island. It was formerly inundated every year, and is still menaced by the Senegal when the river is unusually high. The soil is alluvial. The potable water is derived from the river, but rain-water is also used. The average number of rainy days at St. Louis is thirty-five.

The subjoined table gives the mean temperature, daily range, rainfall, and humidity of this station.

THE METEOROLOGY OF ST. LOUIS.

	Mean Temperature.	Daily Range.	Rainfall, mm.	Relative Humidity.
December, .	21°·6	11°·7	0	61
January, . .	20·0	12·5	7	62
February, . .	20·3	13·6	20	62
March, . .	20·5	10·8	0	73
April, . .	20·5	9·4	0	76
May, . .	21·5	6·8	12	81
June, . .	25·2	6·0	10	81
July, . .	27·2	5·9	76	78
August, . .	27·5	6·9	162	79
September, .	28·1	6·8	127	78
October, . .	27·5	8·1	11	74
November, .	25·1	10·7	0	70
	23·7	9·1	425	73

Dry season, 20°·7. Wet season, 26°·8.

We have already noticed the condition of Dagana during the inundation. The mean annual temperature is 26°·2.

Podor, an inland station in 16° 39′ N. lat., has a mean temperature of 28°·1, which is considerably higher than that of St. Louis.

Matam, about 370 miles east of St. Louis, with a high summer temperature, is highly insalubrious.

Bakel, about 470 miles up the river, is almost surrounded by water in the rainy season, and has extensive marshes near it. The soil is a red ferruginous clay. We shall give the mean and extreme temperatures at this station, in order to illustrate the climate of the interior of Senegambia.

The Meteorology of Bakel.

	Mean Temperature.	Maximum Temperature.	Minimum Temperature.	Difference.
December, .	26°·1	35°·4	14°·6	20°·8
January, . .	24·7	35·5	15·5	20·0
February, . .	26·9	36·8	16·2	20·6
March, . .	29·7	37·4	21·3	16·1
April, . .	34·1	43·6	24·0	19·6
May, . .	32·9	42·3	24·0	18·3
June, . .	30·8	41·5	21·9	19·6
July, . .	26·6	35·2	19·2	16·0
August, . .	27·9	33·6	21·1	12·5
September, .	27·9	35·3	19·0	16·3
October, . .	28·1	34·9	18·8	16·1
November, .	28·4	35·7	16·9	18·8
	28·7	37·3	19·4	17·9

Dry season, 29°·06. Wet season, 28°·28.

The great heat in April and May is due to the Harmattan, or dry wind from the desert, which is opposed to the prevalence of malaria. Malarial fevers are frequent and severe at this station, especially during the cooler season from November to February.

Medine, in 14° 20′ N. lat., is situated on an eminence, and is out of the alluvial plain, where most of the other stations are placed. The climate is similar to, but is rather hotter than, that of Bakel. The mean temperature of the dry season is 30°·06, and of the wet season, 29°·73. The absolute minimum is 17°; the absolute maximum, 42° C.

We shall now notice a few of the coast stations.

Cayor is situated between St. Louis and Cape Verd; the soil is a sandy alluvium. It is very unhealthy.

Goree is a small and barren island to the south of, and close to, Cape Verd. The south-west part is of basalt, the eastern side is sandy. The highest point is only 30 mètres above the sea-level. It has no vegetation and no fresh water. Rain water is used, and has to be supplemented by water brought over from the mainland. The mean temperature at Goree is 23°·8, which is nearly the same as at St. Louis; that of the dry season (December to May) is 20°·6, and of the rainy season (June to November), 27°·0. This island, which of course is not subject to inundation, is regarded as moderately healthy.

Dakar, on the mainland and close to Goree, is about 15 mètres above sea-level. As the soil is light and the rainy season short, the country is dry and arid. In June, July, and August it becomes green under the influence of the rains. It is rather inferior as respects salubrity to Goree. At Hann, a short distance north of Dakar, there is a garden cultivated by means of convict labour; it is traversed by a stream, and the soil is marshy. This place is extremely malarious.

Mbidjem, 37 miles from Goree, is situated at the summit of a slope, which descends to the marshy plain of Tamna. The plain, which forms a semicircle round this post, is transformed into a large marshy lake from the beginning of the rainy to the middle of the dry season. It is very unhealthy, offering a marked contrast to Goree, although the climate of the two places is alike. The reason of this is undoubtedly the difference in the telluric conditions of the two localities.

The mean temperature of Mbidjem is as follows:—

Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21·5	21·8	18·5	21·4	22·5	22·4	25·5	27·5	27·5	28·0	28·3	22·3

The fall in the temperature in November is very marked.

The British Settlements on the Gambia consist of the Island of St. Mary, British Combo, and M'Carthy Island, 187 miles up the river. The capital is Bathurst, built on St. Mary Island, which is a sandbank 3½ miles long by 1¼ miles broad, separated from the mainland by a narrow channel named Oyster Creek. A large portion of the island is covered by swamp, and is in some parts below the sea-level. During the rains, the centre of the island is inundated. The rainy season is July, August, and September. The annual fall is about 39 inches; the number of rainy days, 84. It is notably malarious during the rainy season. The banks of the Gambia, for a distance of 50 or 60 miles from its mouth, are so low as to be nearly on a level with the water, and are covered with impenetrable mangrove bushes, reeds, and brushwood.

M'Carthy Island is about 6 miles in length and 2 miles in breadth. During the rainy season it is often to a great extent under water. In the dry season the soil becomes as hard as a stone, and cracks under the action of the sun. Bradshaw represents the climate during the dry season (November–June) as comparatively healthy. In the rainy season remittent and intermittent fevers prevail.

To the south of the Gambia is the Casamanza river, on the right bank of which is situated the French settlement of Sedhion. The mean annual temperature is here 26°·4. There is very little difference between the temperature of the wet and dry seasons. The number of rainy days is 84.

Boké is situated on the River Nunez, between the Gambia and Sierra Leone. We shall give a *resumé* of the meteorological observations taken at this post in 1878–79:—

The Meteorology of Boké.

	Mean Temperature.	Maximum Temperature.	Minimum Temperature.	Difference.	Number of Rainy Days.
December, . . .	26°·6	33°·0	16°·0	17°·0	1
January, . . .	26·2	34·0	13·8	20·2	0
February, . . .	27·6	34·3	18·0	16·3	0
March, . . .	29·1	37·3	21·0	16·3	0
April, . . .	30·3	39·5	22·0	17·5	4
May, ...	30·1	37·2	24·0	13·2	13
June, ...	28·0	34·5	23·0	11·5	17
July, ...	26·6	30·5	20·0	10·5	26
August, . . .	25·8	28·4	22·5	5·9	30
September, . .	26·2	32·0	23·0	9·0	29
October, . . .	26·3	32·0	22·5	9·5	26
November, . . .	27·5	33·0	22·0	11·0	11
Mean of Year, . .	27·5	33·8	20·7	13·1	157
Dry Season (December to May),	28·31				
Wet Season (June to December),	26·73				

The only other place in this region to which we shall refer is the French station of Benty or Benta, north of Sierra Leone. The climate of this place may be assumed to be similar to that of Boké. Off the coast of Senegambia lie the Bissagos group. They are of volcanic origin, and densely wooded. They are probably as unhealthy as any part of the mainland.

Pathology.—*Malaria.*—It will have been remarked that all the districts of Senegambia occupied by Europeans, whether along the coast or in the interior, are, to a greater or less degree, subject to malarious influences. Malaria is the chief factor in the pathology of Senegambia. Of 66,491 patients treated in the hospitals of St. Louis and Goree during twenty years, no fewer than 26,413 were admitted for malarial fevers. This gives a proportion of 39·6 per 100 of all diseases. At St. Louis, during twenty years, the admissions for fever have been 80·8 per 100 on the effective; and at Goree, for the same period, 83·1 per 100.

The proportion of fever admissions to the admissions from all causes, at Dagana in Lower Senegal, is 48 per cent.; in Upper Senegal (Bakel and Medine), 72 per cent.; and at the coast stations, as high as 87 per cent. The high number of admissions in Upper Senegal is partly owing to the longer sojourn of the troops in this locality.

The influence of endemic conditions upon the health of the troops in Senegambia will be evident by the proportion of admissions and deaths in the French army per 1000 of the troops:—

Admissions per 1000.		Deaths per 1000.	
Malarial Fever, . . .	857	Dysentery and Diarrhœa, . .	19
Anæmia, ...	115	Yellow Fever, ...	17
Dysentery and Diarrhœa, .	296	Pernicious Fever (malarial), . .	13

The extreme unhealthiness of this coast is well illustrated by the fate of a body of English settlers, who, at the end of last century, were foolish enough to attempt to colonise the Bissagos group. Bulama, the largest island of the Bissagos, was selected by Philip Beaver[1] as the site of an English colony. He set out with 275 persons, of whom 57 were women and 65 were children, but defection and other causes largely reduced the number who actually landed in Bulama. They arrived on the island on the 19th July, 1792, that is, during the height of the rainy season. By the 29th of November, 1793, sixteen months after landing, the greater number had either perished from disease or had attempted to escape death by flight; but safety was not to be secured even by quitting these pestilential shores. A fearful mortality occurred on board a vessel that carried off a party of the settlers. Of 28 who embarked in the return voyage, only 5 reached Santiago alive, although the voyage lasted but six days. The rest perished of fever or of the resulting cachexia. The most remarkable circumstance connected with their condition was, that they were mostly reduced to a state approaching idiocy—their intellectual and moral faculties were almost destroyed.

This history shows the effects of climate on settlers subjected to its influence under adverse circumstances. The manner in which the infection operates upon a body of men placed under the most favourable conditions, may be learned from the medical history of a small body of French troops stationed at Benty, on the mainland, and not far from Bulama. The detachment numbered in all 52 persons, of whom 12 were Frenchmen, 20 Algerians, and 20 natives of Senegal. I am not sure whether some of the natives of Senegal had not already been stationed at this post. The number of those, if any, who had been thus circumstanced appears to have been small. The party landed in June, before the commencement of the heavy rains. In June, however, the rains began, and during that month 10 of the Algerians and 2 of the Frenchmen were attacked with a continued form of fever. The fever began suddenly, and lasted about a week without any remissions. The temperature rose to 39° or 40° C., with acrid heat of skin, tongue dry and red, complete anorexia, constipation, enlargement of the spleen, continuous pains in the limbs, intense headache, troubled sleep, and great debility. The liver was not involved, and there was no jaundice. At the end of a week a notable remission took place, ending gradually in a return to the normal temperature. The health of the patients improved for a time after the attack was over, but their strength remained much diminished.

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[1] *African Memoranda*, London 1805.

In July, the French and Algerians suffered from the tertian type of fever, often complicated with bilious symptoms.

In August, the tertian type still prevailed. A native of Senegal died of the ictero-hæmorrhagic form of fever. The tertian type still persisted in September. The French, who were observed to be becoming rapidly anæmic, suffered more than the Algerians.

In November it was observed that every wound ended in profuse suppuration. The fever now assumed an irregular type. A paroxysm of about four hours' duration occurring one day, the patient, although weak, was able to be about on the morrow; then in eight, ten, or fifteen days he was again seized in a similar manner, and these short attacks, with considerable intervals, were repeated.

In January the fever continued of an irregular type, ulcers which had been cured opened afresh.

These irregular attacks of fever, this tendency to suppuration and ulceration, with great debility and increasing anæmia, characterised the condition of the detachment during the succeeding months of its residence at Benty; the men suffered neither from diarrhœa nor hepatitis. We thus find the malarial infection in Senegal to begin with a continued fever of a week's duration; succeeding to this, intermittent fever, first tertian and then irregular, ending in marked cachexia.

The quotidian type is the most common among the Europeans in Senegal, the tertian among the natives. The septan type is also very frequent. The relapse of the quotidian type, according to Borius, takes place most commonly on the seventh, the fourteenth, or the twenty-first day.

The relapses were carefully noted in 226 cases, and the interval of freedom from fever was found to be:

7	days in	18 patients.
14	,,	68 ,,
21	,,	33 ,,
28	,,	9 ,,
Regular intervals, .		128
Irregular intervals, .		98

We have seen that fever, dysentery, and anæmia are the endemic diseases, and these three absorb, pretty much, the pathology of Senegambia.

We have now to notice the seasonal prevalence of malarial fever in Senegal.

Borius has given a series of tables illustrating the prevalence of malarial fever, simple and pernicious, in the dry and wet seasons; in the winter, spring, summer, and autumn seasons, and their prevalence in relation to the conditions of the soil as regards dryness and moisture. We think it would have been more simple and instructive if he had given the average monthly number of admissions for the different forms of fever. We shall try, however, by a selection from these tables, to represent, as far as possible, the leading facts respecting the seasonal prevalence of fever in Senegambia. Dividing the year into the wet and dry seasons, let us see the distribution of twenty cases of malarial fever in the different localities.

	St. Louis.	Goree.	Lower. Senegal.	Upper. Senegal.	Cayor.	Coast Districts.
Dry Season (December to May), . .	6	6	7	11	5	8
Wet Season (June to November), .	14	14	13	9	15	12
	20	20	20	20	20	20

TEMPERATURE OF THE TWO SEASONS.

	St. Louis.	Goree.	Lower Senegal. (Dagana.)	Upper Senegal. (Bakel.)	Cayor.	Coast Districts. (Boké.)
Dry Season, ...	20·7	20·6	24·6	29·06	—	28·31
Wet Season, ...	26·8	27·0	27·7	28·28	—	26·73

At all the stations except those of Upper Senegal, the rainy season is that when fever is most prevalent. It should be observed that at St. Louis, Goree, and Lower Senegal, the rainy season is that during which the mean temperature is highest, whilst at Bakel and Medine, in Upper Senegal, the dry season is warmer than the rainy one. But we are warned against ascribing the greater unhealthiness of the dry season in Upper Senegal exclusively to the greater heat of the dry months, by the fact that at Boké and Sedhion, on the coast, the dry season is also the warmest; but notwithstanding this, the rainy season at these stations is still the fever season.

The two following tables give the distribution of forty cases of fever in relation to season, and to the condition of the soil as respects humidity:—

TABLE SHOWING THE DISTRIBUTION OF MALARIAL FEVER ACCORDING TO SEASON IN VARIOUS PARTS OF SENEGAMBIA.

	ST. LOUIS.				GOREE.			LOWER SENEGAL.		UPPER SENEGAL.			THE LOWER COAST STATIONS.			
	Fevers.	Mean Temp.	Range.	Rainfall.	Fevers.	Mean Temp.	Rainfall.	Fevers.	Mean Temp.[1]	Fevers.	Mean Temp.[2]	Range.	Fevers.	Mean Temp.[3]	Range.	Number of Rainy Days.
Winter—Dec.–Feb.,	8	20·63°	12·6°	27	8	20·40°	3	9	23·67°	12	25·90°	20·5°	10	26·80°	17·8°	1
Spring—March–May,	4	20·83	9·0	12	5	20·83	0	5	25·97	10	32·23	18·0	7	29·83	15·7	17
Summer—June–August,	11	26·63	6 3	248	7	26·87	401	9	28·03	8	28·43	16·03	11	26·80	9·3	73
Autumn—Sept.–Nov.,	17	26·90	8·5	138	20	27·10	128	17	27·33	10	28·13	17·1	12	26·67	9·8	66
	40	23·74	9·1	425	40	23·85	532	40	26·25	40	28·67	17·9	40	27·52	13·1	157

[1] The Mean Temperature is that of Dagana.
[2] The Mean Temperature is that of Bakel.
[3] The Mean Temperature, Range, and Number of Rainy Days are for Boké

TABLE SHOWING THE DISTRIBUTION OF MALARIAL FEVER IN RELATION TO SOIL.

	ST. LOUIS.				GOREE.			LOWER SENEGAL (DAGANA).		UPPER SENEGAL (BAKEL).			COASTS (BOKÉ).		
	Fevers.	Mean Temp.	Range.	Rainfall.	Fevers.	Mean Temp.	Rainfall.	Fevers.	Mean Temp.	Fevers.	Mean Temp.	Range.	Fevers.	Mean Temp.	Range.
Aridity of Soil—February–April, .	4	20·4°	11·3°	20	5	19·8°	2	6	24·8°	11	30·2°	18·8°	8	29·0°	16·7°
First Rains—May–July, . . .	5	24·6	6·2	98	6	25·0	124	6	27·6	8	30·1	17·9	10	28·2	11·7
Rains and Inundations—August–October,	23	27·7	7·3	300	17	27·7	402	18	28·6	9	27·9	14·9	12	26·1	8·1
Fall of Rivers and Cessation of Rains—November–January,	8	22·2	11·6	7	12	22·6	4	10	24·0	12	26·4	19·9	10	26·8	16·1
	40	23·7	9·1	425	40	23·8	532	40	26·2	40	28·6	17·9	40	27·5	13·1

A comparison of these tables shows that malarial fever attains its maximum in the months of September and October at St. Louis, Goree, Lower Senegal, and along the south coast; while, in Upper Senegal, fever is most prevalent in the months of December and January. The maximum thus occurs in all parts of the country, except Upper Senegal, at the beginning of autumn, when the rains are still heavy but diminishing. The cessation of the heavy rains in November, December, and January leaves a large extent of marshy land exposed to the sun's action, yet everywhere, except in Upper Senegal, there is notable diminution in the number of fever admissions during these months. At Goree, where there is no inundation, fever appears precisely at the same time as in the localities subjected to inundation. The fact that the time when most of the country is under water is the time when fever is most prevalent, proves, according to Borius, that fever is not brought from a distance but is contracted on the spot. It is the soil near the dwelling, alternately saturated and dried, that develops the infection. It may, however, be suggested, that as the period of incubation often extends to three weeks or more, the infection really takes place before the inundation has attained its maximum.

The mean temperature during the months of September and October is high at all the stations. It is at its maximum at Goree, St. Louis, and Mbidjem; it is falling at Dagana in Lower Senegal, where the maximum is attained in summer. At Boké, as in Upper Senegal, spring is the warmest season. Nowhere, except in Upper Senegal, does the maximum of fever admissions correspond with the greatest daily range, a fact which tells strongly against the chill theory of malaria so strongly advocated by Oldham and others.

In Upper Senegal the greatest number of fever attacks occurs in winter, when the temperature, although high, is at its minimum, and when the soil is parched; but Borius thinks that this is explained by the frequency of relapses arising from the more prolonged sojourn of the soldiers in these inland stations. I would venture to suggest that the high range between the maximum and minimum temperature during these months in Upper Senegal, compared with that observed along the coast, goes far to explain the greater frequency of relapses during winter in this region. If malaria were most prevalent during the winter in Upper Senegal, as the number of attacks occurring during this season might lead us to suppose, then, as Borius contends, we should expect to find that pernicious fevers, which are the highest expression of the malarious influence, would also be more frequent at this period. Such, however, as we shall presently see, is not the case. It thus appears that the end of summer or the beginning of autumn is everywhere the period when malaria is most prevalent. The period when the crops grow and ripen is the period when malaria is most prevalent.

The general conclusion that Borius deduces from his statistics, the most important of which we have reproduced, is that "along the coasts, at St. Louis, at Goree, at Mbidjem, and even at Dagana, intermittent fevers go on augmenting or diminishing in frequency in proportion as the monthly mean temperature augments or diminishes. 'L'insalubrité est proportionnelle à la temperature moyenne mensuelle.'" This conclusion, at least, in the very precise form in which it is put, is not quite borne out by the tables. The season of highest mean temperature both at Boké and in Upper Senegal is spring, which is not the period of greatest fever prevalence in either of these localities. The temperature is of primary importance in relation to malaria, when it depends upon the procession of the seasons. The high temperature of spring in Upper Senegal is the result of the dry desert Harmattan, which opposes rather than favours the development of malaria. The soil at that season is dry—vegetation is burned up; and, notwithstanding the high temperature, malaria remains in abeyance. It is when the sun in its annual course has acted for a time on a soil containing more or less moisture, that malarious diseases begin to make their appearance. The period of malarial prevalence is determined by season rather than by temperature, unless so far as this is itself determined by the season.

The seasonal distribution of pernicious and of bilious melanuric fevers in the various parts of Senegal is given in the following tables:—

DISTRIBUTION OF FORTY CASES OF PERNICIOUS ATTACKS ACCORDING TO SEASON AND LOCALITY.

	St. Louis.	Goree.	Lower Senegal.	Upper Senegal.	Lower Coast Regions.
Winter—December-February,	3	8	3	6	6
Spring—March-May,	0	4	2	8	3
Summer—June-August,	16	7	11	16	15
Autumn—September-November,	21	21	24	10	16

DISTRIBUTION OF FORTY CASES OF BILIOUS MELANURIC FEVERS ACCORDING TO SEASON AND LOCALITY.

	St. Louis.	Goree.	Lower Senegal.	Upper Senegal.	Lower Coast Regions.
Winter—December–February,	7	12	8	10	9
Spring—March–May,	12	10	7	6	2
Summer—June–August,	13	4	8	9	12
Autumn—September-November,	18	14	17	15	17

If the frequency of pernicious attacks be in proportion to the intensity of the malarious influence, we shall have no difficulty in arriving at the conclusion that malaria is at its height everywhere throughout Senegambia during and after the rains, and that it is at or about its minimum in spring, whether the temperature of this season be at its maximum as in Upper Senegal, or comparatively low, as at St. Louis and Goree. The effect of the high spring temperature of Upper Senegal would be to accelerate the advent of the fever season in this region and at Boké.

Typhoid Fever is met with both among the natives and Europeans, but all observers concur in testifying to its rarity.

Borius never met with a case of *Diphtheria;* I have met with no mention of the occurrence of *Croup.*

Dengue has frequently been epidemic in Senegal.

Yellow Fever.—The following epidemies of yellow fever in Senegal are recorded by Hirsch:—1778, 1830, 1837, 1858–60, 1866–68, 1878.

Asiatic Cholera made its first and last appearance in Senegal in 1868, when it caused a great mortality. *Sporadic Cholera* is common both among Europeans and natives.

Dysentery and *Diarrhœa* are the most fatal complaints of Senegal, at least in Europeans. Here is the seasonal distribution of the disease in different districts:—

Distribution of Forty Cases of Dysentery as regards Season and Locality.

	St. Louis.	Goree.	Lower Senegal.	Upper Senegal.
Winter—December–February, .	10	12	10	12
Spring—March–May, ...	5	8	8	9
Summer—June–August, . . .	11	10	10	7
Autumn—September–November, .	14	10	12	12

Dysentery is at its minimum in spring, and is everywhere most frequent in autumn. In Upper Senegal, where the winter range of temperature is high, dysentery is as frequent in winter as in autumn.

Smallpox is very destructive to the natives, whole villages being sometimes almost destroyed by this scourge.

Measles is said to be more severe than in France.

Scarlatina is unknown.

Whooping-Cough is often epidemic; but *Influenza* is never met with.

Bronchitis, Pneumonia, and *Pleurisy* are by no means rare among the natives; but Europeans are little subject to these complaints.

Phthisis is comparatively rare among the European residents. In the hospital at St. Louis, consumption gives rise to 4·8 per 1000 of the admissions, and to 46·5 per 1000 of the deaths; in Goree, the admissions and deaths are 10·9 and 71·4 per 1000 respectively. In the London hospitals phthisis is said to cause about 121 per 1000 of the total deaths. This seems to show that consumption is comparatively rare among the Europeans in Senegal. It appears, however, to be considerably more common among the natives, among whom it accounts for 20 per 1000 of the admissions. Perhaps the explanation which Borius gives of the rarity of phthisis in this region may be the correct one: "On ne meurt pas phthisique au Sénégal parce qu'on meurt d'autres maladies."

Hepatitis is of frequent occurrence among the Europeans; but the natives are less subject to the disease.

Leprosy is moderately frequent among the native population, both on the coasts and in the interior.

Acute Articular Rheumatism is very prevalent in Senegal, and is often complicated with endocarditis.

Muscular Rheumatism is also common.

Rickets is very rare.

Eclampsia makes many victims among the native children.

In the Portuguese establishments near the Gambia, next to malarial fever and dysentery, the diseases most frequently observed are phagedænic ulcers, elephantiasis, rheumatism, bronchitis, hysteria, pustular skin affections, and cerebral softening.[1]

The diseases which are stated to be most fatal in British Gambia amongst the natives are acute *lung* and *kidney* diseases.

Intermittent Fever, although extremely common, is said not to be very fatal to the natives.

Venereal Diseases of the most virulent forms are excessively prevalent.[2]

[1] Rey, *Archiv. de méd. nav.* vol. xxvi. ; Brassac, vol. xxvi.

[2] *Public Health,* November 1890.

CHAPTER VII.

SIERRA LEONE, SHERBORO, LOS ISLANDS.

GEOGRAPHY AND CLIMATE.—Sierra Leone is a peninsula, 18 miles in length by 12 in breadth, situated in lat. 8° 3′ N. and 13° 18′ W. The interior is mountainous, but a belt of low land stretches along the coast. Freetown, about five miles from the sea, and the seat of the Government, stands on the southern shore of the Sierra Leone river, which is here of considerable breadth. It is surrounded by hills on the south, on the south-east, and from south-west to west. Its slope is turned to the north-east facing the continent. The soil is a red sandstone and clay containing much iron. The water is very pure. Kroo Bay forms a kind of marsh in Freetown. The Bullam shores on the opposite side of the river, and the river banks above the town, are swampy.

Sherboro, to the south of Sierra Leone, is low and marshy, as is also the territory to the north on the Scarcies river.

The Los and Banana Islands belong to Sierra Leone. The Los Islands are of granite formation, with a scanty vegetation.

The mean temperature of Freetown at 9 A.M. oscillates between 81° and 84° F. The average of the absolute maxima for the year, in 1881, was 93°·3, and of the absolute minima, 69°·9. The rainfall is excessively heavy, often reaching 100 inches or even more. It is very variable, however, both in amount and distribution. The dry season extends from November to March. The heaviest rains fall in August and September.

PATHOLOGY.—Sierra Leone has the reputation of being one of the most unhealthy parts of Africa. The ratio of deaths per 1000 among the white troops from 1817 to 1837 was 483. In other words, the average annual mortality, over a period of twenty years, was nearly one-half of the strength.

Parkes considers that this great sickness and mortality is attributable chiefly to local causes and individual faults.[1] Before 1828, the barracks were placed at the base of Tower Hill, on a bad site. They were badly built and overcrowded. The men, recruited from soldiers whose punishment had been commuted in England, were dissipated and disorderly. Their rations up to 1828, as Gore tells us, consisted principally of salt pork and salt beef. It was inevitable that the mortality amongst a body of men of this character, and so lodged and fed, should be high, even if the climate had been a healthy one; but an annual mortality of one-half of the strength extending over twenty years seems, none the less, to indicate that the climate is one singularly unfavourable to the European constitution. This view is confirmed by the records of the Navy. Gore states that the ratio of admission in the ships of war on this station in 1866 was 2067·8 per 1000; while on the China station the ratio was 1470·7, and on the North American and West India station, 1432·4 per 1000.[1]

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[1] Parkes, *Hygiene*, London 1878, p. 652.

In the *Navy Report* for 1855, it is noticed that the *Flirt* returns 64 cases of ague and 6 of remittent fever contracted at Sierra Leone out of a complement of 97 officers and men. "Up to the middle of July the weather was fine, but during the latter part of the month there were frequent rains, and in August the rain was almost continuous. This latter was the most unhealthy part of our stay"—the principal diseases being malarial fevers and rheumatic affections.

Dr. Lovell, who resided for some years at Sierra Leone, informs me that few Europeans live long in the Colony without losing their health. Such also was the opinion of Daniell.[2]

The black troops stationed here, although they are liable to phthisis and other chest diseases, do not suffer much from endemic fever.

The admission rate per 1000 for paroxysmal fevers from 1859 to 1866 was 117·2; for continued fever, 2·1; and for dysentery and diarrhœa, 33·6 per 1000.

Local conditions count for much in Sierra Leone, as in all malarious countries, as regards the health both of natives and strangers. A schoolroom built on a site overlooking the marshy Kroo Bay proved so unhealthy, both to teachers and pupils, that it had to be closed. Vessels trading up the river suffer much from malarious diseases. "Ships frequently arrive at Freetown having lost one-half or two-thirds of their crew from remittent fever contracted in the neighbouring rivers, the exhalations from the mud banks of which are highly malarious" (Gore). At Sherboro on the south, and Scarcies in the north, fever and dysentery prevail. The Los

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[1] Gore, *Medical History of Sierra Leone, Army Medical Report*, 1867.

[2] Daniell, *Med. Top. Gulf of Guinea*, London 1849.

Islands have proved unhealthy, but it is difficult to distinguish how much of the sickness has been caused by malarial fever and how much by yellow fever.

The fever of Sierra Leone, as it affects Europeans, is chiefly of the remittent type, and of the intermittent type among the natives. Where yellow fever is so frequently epidemic, as is the case in Sierra Leone, it is often difficult, in reading the rather vague accounts of different outbreaks, to say whether in any particular instance we have to do with malignant remittent or with genuine yellow fever. It appears probable, however, that true malarial fever does pretty frequently assume at Sierra Leone the two most marked features of yellow fever, viz. jaundice and black vomit. Gore, for instance, describes a sporadic case of this kind in 1835, at a time when yellow fever was not epidemic, and some of the recorded outbreaks of fever by this author in which black vomit occurred may possibly have been of a malarious origin.

The fever which attacked the men in H.M.S. *Plumper*, who were on boat service among the mangrove swamps of the Rio Pongas, in December 1829, was characterised by great pain in the spine, a dirty leaden hue of the skin, and towards the end it became complicated with diarrhœa. Vascularity of the stomach, inflammation of the great intestines, enlargement of the liver, and enlargement and softening of the spleen, were the most marked pathological lesions. It was remarked that those cases of fever contracted on the margins of the swamps were generally more virulent than those originating in the more open parts.

In 1865 a form of remittent fever was very fatal among the European residents, of whom 29 per cent. died. Of three non-commissioned engineer officers, two died of it, and the third was invalided. It was characterised by symptoms of cerebral congestion, which almost invariably ended fatally. The patient, while feeling slightly relieved from the febrile symptoms, would be suddenly attacked with coma. There was suppression of urine, congestion of the conjunctivæ, irregularity of the pupils, difficulty of swallowing, singultus and subsultus tendinum, terminating in death. Just before death the contents of the stomach were ejected. If the patient recovered from the primary attack, the convalescence was very precarious, and a relapse invariably proved fatal.

Enlargement of the Spleen is uncommon at Sierra Leone. This, in Gore's opinion, is probably owing to the large percentage (30·187 per cent.) of iron in the soil; but enlarged spleen is common among the native and Creole children residing in the swampy districts bordering on the rivers.

As a general rule, according to Gore, the sickness and mortality in Sierra Leone stand in inverse relation to the rainfall (*Army Medical Report*, 1867).

Typhoid Fever is apparently of rare occurrence in Sierra Leone.

The following outbreaks of *Yellow Fever* are recorded by Hirsch:—1816, 1823, 1825, 1829–30, 1837–39, 1845–47, 1859, 1862, 1864, 1865–66, 1868, 1878 (?).

Dysentery and *Diarrhœa* are endemic in Sierra Leone, but they are less common and fatal than in many parts of the west coast.

Respiratory Diseases are common amongst the natives.

Leprosy, although not very prevalent, is met with both in the Colony and in the interior.

Negro Lethargy, or the sleeping sickness, a singular and imperfectly understood disease, occurs all along the coast from Senegal to the Congo.

Frambœsia is also prevalent from Senegal to Angola.

CHAPTER VIII.

THE COASTS OF GUINEA.—LIBERIA, GRAND BASSAM, GOLD COAST, ETC.

LIBERIA stretches along the Grain Coast from Sherboro to Cape Palmas. Its climate has not proved unfavourable to the health of the emancipated negroes for whom this settlement was founded; although, from the fact that the first attempts at settlement failed owing to the unhealthiness of the site chosen, we may infer that here too malarious foci of considerable intensity are met with. June is the rainiest month, and the heavy rains last until November. On the Ivory Coast is the French post of Grand Bassam. This part of the coast is low, flat, and marshy, studded with many lagoons and lakes, and covered with stagnant pools after the rains and inundations. The mean annual temperature at Grand Bassam is from 27°·6 to 28°·0 C. Simple intermittent fever forms 83 per cent. of the admissions among the Europeans; anæmia and cachexia, 6 per cent.; then follow billious remittent, dysentery, and pernicious fevers. Among the natives 54 per cent. of admissions are for intermittent fever, and 32 per cent. for dysentery. It thus appears that, while the Europeans suffer more from fever, the natives are specially liable to dysentery.

Grand Bassam was visited by yellow fever in 1852, 1857, and 1862.

THE GOLD COAST.[1]

GEOGRAPHY.—The Gold Coast Colony extends between long. 5° W. and 2° E., and inland for a distance varying from 70 to 100 miles. The principal stations along the coast are Axim, Dixcove, Elmina, Cape Coast, Salt Pond, Accra (now the headquarters of the Government and the capital of the Gold Coast), Ada, and Keta. Along the coast there is in places an extensive lagoon formation. This has evidently resulted from the combined action of the continuous surf which beats on the coast and material carried down by the large rivers. For example, in connection with the River Volta there is an extensive lagoon which stretches from Ada beyond Keta, a distance of between 30 and 40 miles, with a breadth in places of 10 miles. Except close to the shore, the country is one continuous forest, with gigantic trees, the intervals between which are filled up with bush 10 to 15 feet high. The interior of the country is undulating. Reed-covered swamps are met with in the valleys.

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[1] This account of the climatology of the Gold Coast has been written by Dr. Prout, who has for several years been Government medical officer in the Colony.

CLIMATOLOGY.—Systematic meteorological observations have been taken at Accra since 1886, and the results are given in the following table:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature, . .	80·5	81·5	81·6	81·5	80·2	79·1	77·5	76·4	77·9	79·3	80·2	80·4
Rainfall, . . .	0·4	1·2	2·6	3·6	6·5	8·2	1·6	0·0	1·1	2·1	1·2	0·6

The mean temperature, daily range, and rainfall at Elmina is given as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature, . .	79·7	80·8	81·7	81·5	80·6	79·2	76·8	75·0	75·6	78·6	80·6	80·4
Range, . . .	10·6	10·3	10·6	11·7	11·7	10·8	8·8	9·2	9·0	9·9	10·4	10·4
Rainfall, . . .	0·04	1·39	1·89	3·23	7·40	6·73	1·69	1·06	0·91	2·36	2·13	1·42

The mean temperature at Accra for the four years (1886–89) was 79°·48. The extreme annual range of temperature is about 29° (from 64° to 93° F.). The mean range is, however, only 12° to 13°. The percentage of humidity is high, always over 65 per cent., and occasionally reaching a monthly average of 87 per cent. Ninety-five per cent., or almost complete saturation, is occasionally attained. The rainfall is comparatively small, and varies considerably in different years, *e.g.*, 1886, 22·73; 1887, 34·86; 1888, 34·96; 1889, 23·61. The daily rainfall is not very great, and rarely rises above 2 or 3 inches, but 6·5 inches have been known to fall in one day. The rainfall is distributed unequally throughout the year, as will be seen from the above table. It may be mentioned here that the rainfall is very unequal at different places along the coast. For example, judging from my own experience, the rainfall at Axim must be twice or thrice as great as at Accra, but no accurate observations have been taken at the former station.

The seasons on the Gold Coast may be divided roughly into two, the rainy and the dry. The rainy season begins in March or April,—being generally ushered in by tornadoes,—reaches its maximum in May or June, and finishes in July. It may be noted that in 1886 it began early, and in 1889 it lasted until August. After the rains there is a short dry season of two months. Then follow the after-rains in October generally, but sometimes beginning earlier or lasting later.

It will be seen from the tables that the interval between the rains is the coolest season of the year, the mean monthly temperature then falling to 75° or 76°.

The dry season lasts from about November to March. The first part of this, from November to January, forms the Harmattan season. During this period, what is known as the Harmattan wind blows at intervals, chiefly from the north-east, and is usually accompanied by a thick white haze, which extends some distance out to sea. This wind is characterised by its excessive dryness, which can hardly be credited until it is experienced. The skin becomes dry and crackly, the eyelids feel hot, the nostrils are dry, and the mouth parched. Furniture creaks and splits in the most eerie fashion, glasses crack unexpectedly, and the water in coolers becomes many degrees cooler from the rapid evaporation which takes place. Although this season may be regarded from its effects on the natives as their winter, yet it will be seen that the temperature is now rising, until it reaches its maximum during February or March. Scattered tornadoes now take place, and once more the rainy season is approached.

During the rainy season the most prevalent disease is undoubtedly malaria. There is a tendency for the maximum fever rate to occur later than the maximum rainfall, and for a high fever rate to persist after the rainfall has diminished, which would incline me to believe that on the Gold Coast it is the drying-up process *plus* the other climatic conditions, which is most favourable to the production of the malarial poison. Of the four years 1886–89, 1887, with its heavy rainfall, was the most unhealthy, and the type of fever during that year was very severe, hæmoglobinuric attacks being common.

The Harmattan season is generally considered a healthy one for Europeans, but old residents suffer from congestive attacks of the liver. In fact, the type of disease during this season is generally of a congestive character, due evidently to the rapid cooling of the skin by the Harmattan wind. This is seen among the natives, who suffer much from bronchitis and pneumonia, the latter of which is frequently very fatal.

PATHOLOGY.—*Malaria.*—The varieties of fevers met with on the Gold Coast are the same as elsewhere, but the prevailing characteristic is their irregularity, more especially as they are seen in Europeans. The quotidian and tertian types, with their well-marked cold, hot, and sweating stages, are rare, and when seen are generally to be found in natives, or in Europeans who have been long resident on the coast, or in those who have suffered from attacks of malarial fever elsewhere. Apparently some process of acclimatisation goes on, and the type of fever in the European approximates after a time to that found in the native, which, as a rule, is a mild form, characterised by a short shivering stage (sometimes absent), well-marked hot stage, and profuse sweating, with a tendency to recur at the same hour on the following day, a recurrence which can almost invariably be prevented by treatment. Of course, I am speaking generally,—natives do suffer from bilious remittent, and, I am told, even from the hæmoglobinuric form (though I myself have never seen a case in a native), but this is the exception. These mild intermittents are very frequently associated with constipation and sluggishness of the liver, and a dose of calomel is often sufficient to cure them.

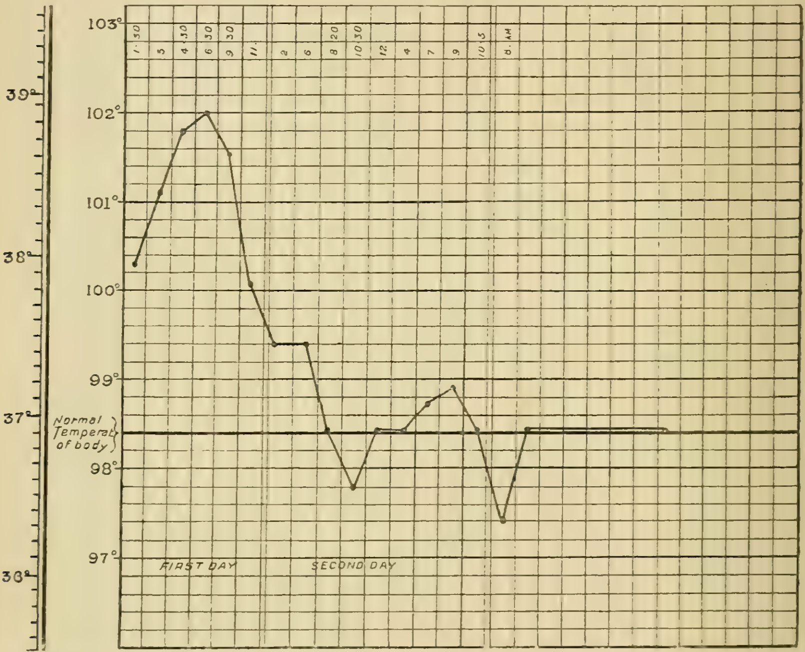
Among Europeans the most usual form of fever, more especially in newcomers, is bilious remittent. I may safely say that no European escapes a severe attack of fever during some period of his stay upon the Gold Coast. This type of fever is almost always accompanied by marked nausea and vomiting, and consequent inability to retain food, which constitutes one of its dangers, and appears to be dependent to a large extent upon the amount of liver complication. It is often accompanied by tenderness, or at least uneasiness, over the liver, by the vomiting of pure bile, and yellowing of the conjuctivæ and buccal mucous membrane. It is followed by great debility, which is more severe and prolonged than I have seen it in Mauritius. Occasionally patients appear to be unable to recover from this, and fall into a dangerous cachectic state, with great anæmia, languor, inability to digest food, etc. Treatment is of little avail under these circumstances, and a change of air, preferably a sea voyage, is the only chance of recovery.

Another form which mainly affects Europeans, but which is fortunately not common, is a remittent fever accompanied by hæmoglobinuria, or, to give it the name by which it is known upon the coast, "blackwater fever." It almost invariably occurs in individuals who have become debilitated through repeated attacks of fever, mental worry, excesses, etc., and is rarely seen in people of robust health. Certain individuals appear to be particularly susceptible to it, for cases are known where there have been four or five attacks, at intervals, in the same individual. Its main characteristics are intense, frequently intractable, vomiting, bilious at the beginning, and latterly consisting of the liquids imbibed with black shreddy particles floating in it; a bright lemon yellow coloration of the skin and conjunctivæ, and urine of a dark porter colour. It froths easily, stains the side of the vessel containing it a bright crimson, and contains large quantities of hæmoglobin, which can be seen microscopically in the form of granules and casts. Blood corpuscles are absent. This form is a very serious one, and the prognosis is always grave. Recovery may take place, the urine gradually becoming normal, leaving the patient in an almost bloodless condition, or death may result from exhaustion due to the enormous destruction of blood, or from uræmia arising from suppression of urine.

The following notes of three cases of fever in Europeans will serve to illustrate the types to which I have already alluded, viz. the mild, the bilious remittent, and the hæmoglobinuric forms:—

Case I. Mild type.

This attack occurred to myself some considerable time after I had been on the coast. It began with a feeling of chilliness, which came on immediately after my usual tepid bath, about eleven in the morning, and was only momentary in duration. By about twelve o'clock, I began to feel headachy, and to suffer from soreness of the muscles of the neck. Face felt hot, and about 1.30 I took my temperature, and found it to be 100°·3; 3 p.m., temp. 101°·1, took 15 grains quinine; 6.30, temp. 102°, repeated quinine; 9.30, beginning to perspire, temp. 101°·5; 11, sweat pouring profusely off me, and temperature falling; took a dose of blue pill.

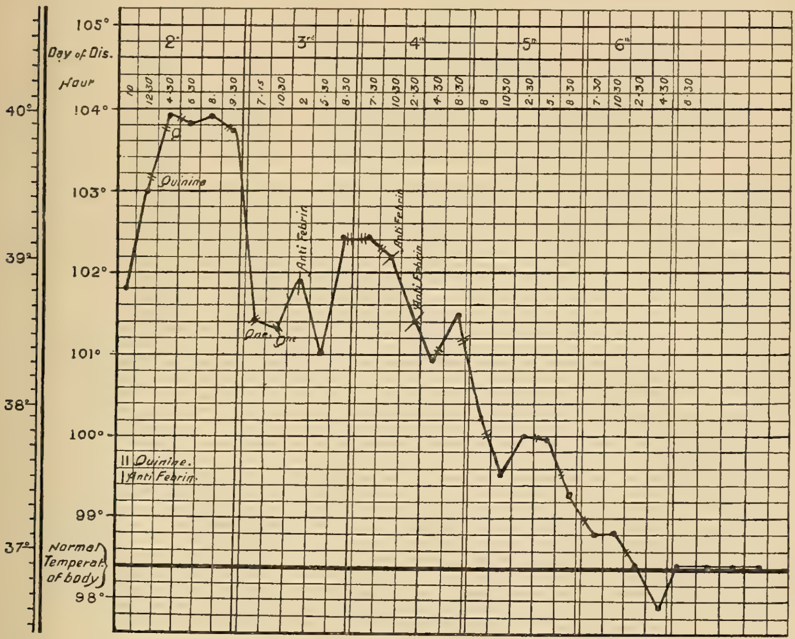


Second day. 2 a.m., temp. 99°·4; 6 a.m., temp. 99°·4, took a dose of effervescing saline; 8.30 a.m., temp. 98°·4, bowels freely moved; felt well, but not equal to exertion; 10.30 a.m., temp. 97°·8; 12 noon, temp. 98°·4, took 10 grains quinine; 7 p.m., temp. shows tendency to rise, 98°·7. It rose to 98°·9, and by 10.30 had again fallen to 98°·4.

Third day. Temp. subnormal in morning, 89°·4. No further return of fever, and a few days of tonic treatment completed my recovery.

Case II. Bilious remittent. R. M., German, trader; age, 27.

Second day. Patient was attacked with fever yesterday evening. Had been feeling out of sorts for some days. Saw him at 10 a.m. Face pale, skin hot, but moist. Pulse 80, soft and compressible. Temp. 101°·9, tongue parched. Patient had been constipated, but had taken a dose of saline in the morning, which only acted very slightly. Ordered calomel, gr. 5, at once. At 12.30, temp. 103°. Great headache. Pains in loins. Gave quinine, gr. 10. During the rest of the day the temperature rose until eight, when it showed a tendency to fall. Bowels have been freely moved.



Nausea is constantly present, and patient has difficulty in retaining medicine or food. Gave chloral, gr. 20.

Third day. Patient feels better this morning. Temperature has fallen to 101°·4. Pulse 76. The temperature began to rise after ten, and at two a dose of antifebrin (7½ grains) was given, which reduced the temperature. In the evening, the temperature again rose. Suffers constantly from a feeling of nausea, and vomiting has taken place at intervals. Thirty grains of quinine were given throughout the day. There has been no stool, and accordingly gave Pil. Hydrarg. gr. iii.

Fourth day. Patient had a bad night. Temp. 102°·4 in morning. Skin hot and dry. Feels weak and exhausted. Tongue furred.

Feeling of nausea persists. There is slight tenderness over liver. During day temperature gradually fell under the influence of antifebrin, but the nausea persisted. Bowels moved several times. Quinine was given at intervals.

Fifth day. Condition generally better. Temperature distinctly lower, but no nausea or vomiting. Tongue still much furred; 50 grains quinine given throughout day.

Sixth day. Temperature reached normal for first time. Tongue cleaning from edges. Was able to move patient from his room to another for a few hours.

Seventh day. Temperature normal. Patient fairly convalescent, but very weak. Tonic treatment prescribed.

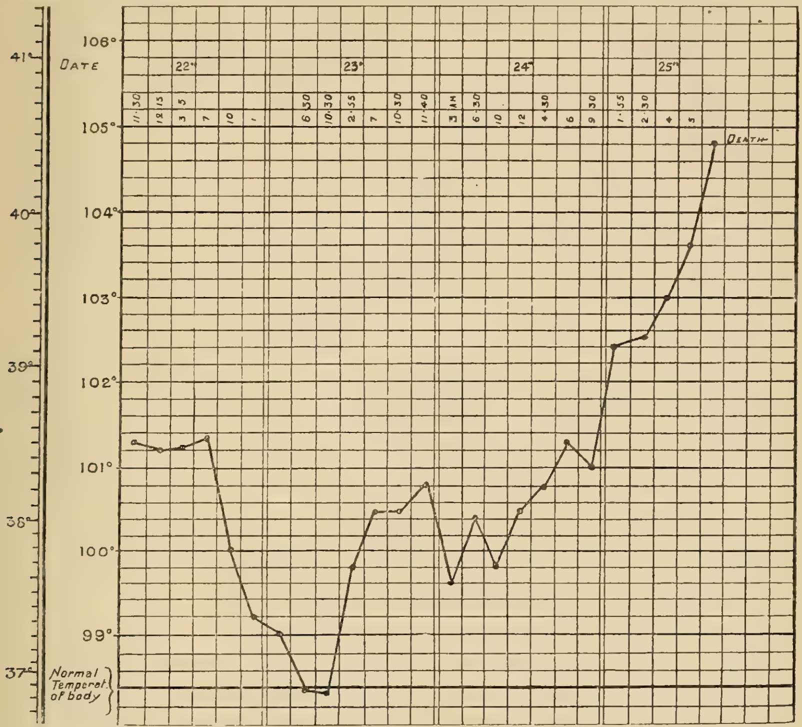
Case III. J. S., Englishman; age about 32.

Patient had come to Accra on a visit, and when there it was observed that he was looking pale and anæmic. Before this he had been suffering from repeated slight attacks of fever, and had undergone a good deal of mental worry. His habits were fairly temperate, but he was somewhat addicted to beer-drinking, a very dangerous form of beverage on the coast in my experience.

I was called to see him one day about eleven o'clock. He told me that he had been vomiting all night, and that this morning he had noticed that his urine was black. He had also had a very bilious and acrid stool.

Present condition. Patient excited and restless. Skin of a bright yellow colour and moist. The perspiration has a peculiar disagreeable odour. Conjunctivæ, and buccal mucous membrane also, yellow. Tongue furred and yellow. Stomach very irritable. Patient is unable to retain anything for any length of time. There is tenderness over the liver, which is enlarged. No tenderness over the spleen, which was also enlarged. Urine of a dark porter-like colour, and almost syrupy in consistence. It froths easily, and stains the vessel containing it red at the edges. Microscopically, it consisted almost entirely of pigment granules and pigment casts, but no red blood-corpuscles. Temp. 101°·3. During the day the conditions remained about the same, the nausea and vomiting persisting. After seven the temperature began to fall, and by twelve (midnight) had reached 99°·4. The treatment adopted was a 10-grain dose of calomel, the hypodermic injection of quinine (neutral hydrochlorate), and antipyrine. Champagne, Liebig's extract of meat, and peptonised foods were given at intervals and in small quantities. Sinapisms were applied to the epigastrium, and bismuth, etc. given to try to check the vomiting.

Second day. At 6.30 a.m. the temperature was normal, and remained so until 10.30, after which it began to rise. The vomiting continued, and as the patient was becoming weaker, nutritive enemata were given at short intervals. The absorptive power of the stomach seemed to have disappeared. The sips of fluid which were taken to moisten the mouth appeared to accumulate unchanged in the stomach, until there was a certain amount of distension, when vomiting took place and the patient felt temporarily relieved. The temperature rose steadily throughout the day, and reached its maximum (103°·8) between eleven and twelve. The urine improved in appearance, and towards evening showed very slight traces of hæmoglobin, but the quantity diminished markedly, and showed signs of total suppression. Treatment as before, with the addition of a diuretic mixture and local applications to loins.



Third day. The temperature continued to rise, and the general condition showed no signs of improvement. Only a few ounces of urine were passed during the day of a yellow colour. Patient was very restless, and wandered slightly in his mind. During the course of the night the patient became distinctly delirious, there was subsultus tendinum, and latterly slight convulsions, probably uræmic in origin. The vomiting persisted, hiccough became marked, and patient became gradually unconscious about half-past six on the morning of the fourth day. Temperature in axillæ after death, 104°·8.

Dysentery is uncommon among Europeans, which is due probably to the fact that the water-supply is derived from rain stored in tanks, and that filters are universally used. Chronic dysentery is fairly common among natives, but true acute tropical dysentery, with its unmistakeable symptoms, which I have seen very frequently in Mauritius, is, so far as my experience goes, extremely rare on the Gold Coast.

Typhoid Fever.—I have never seen nor heard of a case.

Yellow Fever has never appeared on this part of the coast.

Smallpox breaks out from time to time in severe epidemies, one of which occurred during the latter end of 1888 and beginning of 1889, at Accra and other coast stations as well as inland. It is very fatal among the natives, due partly to their uncleanly methods of treatment, and to their want of care of the sick. There has been, and still is, an erroneous idea prevalent among Europeans, that smallpox, as seen on the coast, is a disease confined to negroes, and that Europeans cannot contract the disease from them. During the epidemy referred to above, however, a German resident at Keta suffered from smallpox, showing that Europeans are liable to infection. No doubt the immunity enjoyed by them has been due to their having been vaccinated. It is worthy of note that tribes in the interior, for example, the Houssas, from whom the Gold Coast constabulary are recruited, are in the habit of inoculating themselves from mild cases; but, among the coast tribes, it is often difficult to prevail upon the people to undergo vaccination. This is accounted for by the influence of the fetish priests, who object to the elaborate ceremonies which are required to drive away the smallpox demon, and the pecuniary harvest which results from them, being interfered with by the simpler process of the European medicine man.

Phthisis I have not found to be common. For example, from 1886 to 1889 not a single case is entered on the sick list as having occurred among natives.

Syphilis is very widely diffused, giving rise to 35 per 100 of the hospital admissions.

Rheumatism is common so far as its chronic manifestations are concerned. The majority of cases are of a trivial character, and are chiefly myalgic. Acute rheumatism is met with, but is rare.

Cancer is found, but is uncommon. *Beriberi* is also rare.

Elephantiasis is frequently seen, and, as elsewhere, affects the feet, testicles, and breasts. It appears to be much more prevalent in certain districts on the coast than in others.

Leprosy is common, and occurs both in the tubercular and anæsthetic forms.

Yaws, a peculiar eruptive disease, which appears to be confined to negroes, is extremely common. It begins with a small papule, which increases in size until it forms a warty growth. Several of these may coalesce and eventually form a large open sore. Patient recovers usually, but is left in a very debilitated state. It appears to be contagious.

Clarke[1] mentions the existence of *Ainhum* among the negroes of the Gold Coast.

LAGOS.

Lagos lies to the east of the Gold Coast, in the Bight of Benin. The Bight of Benin comprises a tract nearly 360 miles in extent, and, excluding some parts of the Slave Coast, it may be considered as one vast and almost interminable forest swamp, whose continuity is broken only by the petty rivers and creeks that meander through it in all directions.[2] The coast is skirted by lagoons divided from the sea by strips of land varying in width from a hundred yards to two or three miles. They extend with little interruption from Port Novo on the west to the mouth of the Niger on the east. The peculiar odour of the swampy exhalations is perceptible at the distance of several miles out at sea.

The town of Lagos (Lakes) is situated in 6° 24′ N. lat. and 3° 22′ E. long., at the confluence of the rivers Ogun, Oshun, and Ossa, which at this point unite to form the Kradu lake or lagoon, and, discharging themselves into the sea over the Lagos bar, form a delta. A sandbank, 3 miles long by 1 mile broad, constitutes the Island of Lagos, on which the town is built. The highest part of the island does not exceed 30 feet, and a large portion of it is actually under the sea-level, and consequently swampy. The surface soil is sand to a depth of from 6 to 16 feet, underneath which is argillaceous earth.[3] The native population numbers 36,000; the Europeans, 80 to 90 only.

The seasons are reckoned thus:—

The Greater Rainy Season, ...	March 15th to July 15th.
The Lesser Dry Season, ...	July 15th to September 20th.
The Lesser Rainy Season, ...	September 20th to December 1st.
The Greater Dry Season, ...	December 1st to March 15th.[4]

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[1] Clarke, "Top. and Diseases of Gold Coast," *Trans. Epidem. Soc.* 1863.

[2] Daniell, *Sketches of the Med. Top. of the Gulf of Guinea*, London 1849.

[3] Rowe, *Army Medical Report*, 1862.

[4] Féris, *Arch. de méd. nav.* vol. xxxi.

The mean temperature and rainfall for 1886 was as follows:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	79·10	83·88	83·30	84·51	82·64	79·34	78·46	78·10	78·98	79·53	81·50	78·27
Rainfall, . .	1·97	1·13	6·44	3·81	8·5	7·24	4·57	2·35	6·04	10·27	2·47	1·83
Monthly Total Mortality (1868–73), .	389	387	321	336	366	343	337	281	261	263	266	332

PATHOLOGY. — *Malaria.* — According to Daniell, the Bight of Benin is without exception the most deadly part of the west coast. The Benin river is, he says, more unhealthy than the Rio Formosa.

The subjoined table gives the ratio of admissions among troops (black) for the eight years 1859–66, from paroxysmal fevers, continued fevers, and dysentery, for Sierra Leone, Gambia, and the Gold Coast, including Lagos:—

	Sierre Leone.	The Gambia.	The Gold Coast, including Lagos.
Paroxysmal Fever, . . .	117·2	304·5	353·2
Continued Fever, . . .	2·1	4·8	1·0
Dysentery, ...	33·6	88·7	222·2

The ratio of deaths per 1000 from all causes for the three stations during the same period was:—

Sierra Leone.	The Gambia.	The Gold Coast, including Lagos.
27·29	32·00	47·21

In 1886, the fever admissions in the hospitals, which I understand are chiefly devoted to the treatment of the natives, formed 15·4 per cent. of the total admissions, and the fever deaths, 17·4 per cent. of the total deaths. Enlarged spleen is endemic, and no white man resides long in Lagos without suffering from enlargement of this organ. In addition to fever and dysentery, which are the dominant diseases, ulcers of the legs are so common that sound legs are the exception.

The nature of the fever here is very similar to that observed in the Gold Coast; cerebral complications are frequent in the white residents. Fonssagrives thus states the result of a passing visit to Lagos in the brig *L'Abeille*. "We drew up," he says, "near to the mouth of the marshy river of Lagos, and the breeze from the land brought us, during about ten minutes, the emanations from the shore, the impression of which was distinctly experienced by all on board. We almost immediately went out to sea, and the next morning a dozen of fever patients (among 114 men) appeared. Before this there were no fever cases."

Abeokuta, in the Yoruba country, about 80 miles inland from Lagos, is situated in lat. 7° 8′ N. and 3° 20′ E., at the height of 567 feet above the sea. The seasons here are pretty much the same as at Lagos. The warmest months, which are also comparatively dry, are December, January, February, and the first part of

March. April and May are distinguished by tornadoes and thunder; June is generally the wettest month of the year; about mid-July and August there is nearly an intermission of the rains, and the weather is cool and pleasant. September is again rainy. From October to the middle of November is the second tornado season.

Burton says that the rainy is also the healthier season; the worst months are those before and after the rains; the best are the wet months, especially August and September. Fever, dysentery, and diarrhœa are the prevailing maladies.

THE NIGER, ITS DELTA AND VALLEY.

The delta of the Niger consists of an immense mangrove forest, cut up into islands by the numerous branches of the river, the principal mouths being the Bonny, the Mari, and the Nun. The whole of the delta is pestilential. Every year the English ships of war which have to enter its mouths become disabled from the outbreak of fever. In 1884 the *Alecto* records 13 cases of ague and 63 of remittent fever contracted here. The ship's company had suffered so much in the Niger Expedition of 1883, that at the end of July 1884 the men had to be sent home, a fresh company being received from thence. The ship continued on the same part of the station. On the 29th of September she entered the Niger, and was employed there until the 19th October. While in the river the ship lay for a time both at Akasse and Anamba Creeks, two very malarious localities. Up to their arrival at Anamba Creek, on the 30th September, the men were in good health; the first case of fever occurred on the 11th of October, and from that date till the 9th November every one on the ship had been down with it, except the captain and five men. It has often been remarked that vessels may cruise for a year or more off the west coast, and the men enjoy perfect health, provided they do not land or anchor near the shore.

Little that is definite is known respecting the health of the country along the lower part of the Niger and its tributary, the Benue or Ischadda. From the large amount of sickness amongst the crews of the different exploring expeditions up the river, it would seem that its banks, in this part of its course, are malarious. In the expedition of 1832, the vessels ascended as high as Rabba on the Kworra or Niger, and to Dagbo on the Ischadda. Only 9 out of 49 Europeans returned alive. In the expedition of 1841, the white men on board the three steamers numbered 145, the black men 158; of the former 130 were attacked with fever, and 39 died; only 11 of the coloured men took fever, and none of them died. This *River Fever*, as it has been called, was, according to Pritchett, in almost every case to be traced to exposure to the sun. It must be observed that the stay of the vessels up the river extended only from forty to sixty days. The symptoms, as recorded by Pritchett, were those of remittent fever, with marked pain in the joints, a tendency to collapse, great headache with delirium, and enlargement of the spleen.[1]

The Houssa and Sokoto country, draining into the Niger on the east, is little known. Still farther east is Bornu, extending between 10° and 15° N. lat. and 12° and 15° E. long. The country is level, and is traversed by the Shary and Ysou rivers, the borders of which are covered with dense forest. These rivers overflow the country through which they pass. The heat from March to June ranges from 104° to 107° F. During the rainy season deadly fevers prevail along the marshy shores of Lake Ichad and in many parts of the surrounding country.

Timbuctoo, on the left bank of the Niger, is only 800 feet above the sea-level, although it is more than a thousand miles from its mouth. This shows the small amount of fall that the river has, and the flatness of the country through which its flows. The flat land around the town is frequently inundated, leaving swamps, which are supposed to generate the fevers that Barth and Lenz found, to their cost, to be prevalent in the neighbourhood. The banks of the Upper Niger are marshy almost throughout its entire course during the rains, and intermittent and remittent fevers are common.

The country of Air or Asbeen, extending from 17° to 20° N. lat., and from 8° to 9° E. long., is fertile and sustains a considerable population. Barth considers the capital, Agades, as regards health, to be suitable for the residence of Europeans.

In the French Soudan, east of Senegambia, the diseases are similar to those of Senegal. Malarial affections predominate. Lafont[2] says that in the French campaign of 1887–88, not a single European escaped. Fever was most severe in December, January, and February—the drying-up season. It diminishes in intensity in the three following months, and increases again on the appearance of the first rains, then diminishes in frequency, to recommence with vigour at the beginning of the dry season.

Malarial Cachexia and *Tropical Anæmia* are common and fatal.

Pernicious Attacks are numerous. The bilious hematuric form is frequently observed. It chiefly attacks Europeans whose constitution has been already undermined by malaria.

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[1] Pritchett, *Some Account of the African Fever*, London 1843.

[2] *Archiv. de méd. nav.* 1889.

Typho-malarial Fever broke out wherever troops had been concentrated for some time.

Diarrhœa and *Dysentery* were found to be extremely frequent.

Diseases of the Liver were rather rare, and occurred as sequelæ to diarrhœa and dysentery. The natives suffered greatly from ulcers, diarrhœa, bronchitis, and broncho-pneumonia.

THE BIGHT OF BIAFRA.

GEOGRAPHY AND CLIMATE.—The Bight of Biafra commences at Cape Formosa, and embraces the whole coast to Cape Lopez. It is mostly level, but at the Cameroons it is mountainous, and high lands are again met with to the south near the Equator. The whole of this country is more or less unhealthy, except perhaps the high peaks of the Cameroons.

The Gaboon, in the extreme south of the Bight of Biafra, is a French settlement, respecting the medical topography and climatology of which Dr. Bestion has given us some information. The country along the shore is low, with many shallows and much stagnant water. The subjoined table gives the temperature, relative humidity, and rainfall of this post for the year 1863:—

METEOROLOGY OF THE GABOON.

Months.	Temperature.			Relative Humidity.	Rainfall, m.
	6 A.M.	1 P.M.	10 P.M.		
January, . .	26·4	29·9	27·5	88·5	0·12
February, . .	25·6	30·1	28·2	88·0	0·24
March, . .	26·5	30·6	28·0	85·6	0·50
April, . . .	26·0	30·5	27·5	86·7	0·87
May, . . .	25·8	29·8	27·8	87·1	1·03
June, . . .	25·2	29·1	26·8	82·5	0·10
July, . . .	24·5	28·1	25·5	79·6	0·00
August, . .	24·5	28·3	25·8	81·0	0·06
September, . .	25·4	28·5	26·5	88·0	0·13
October, . .	25·2	28·3	27·5	90·0	0·25
November, . .	25·7	29·1	27·1	90·0	0·22
December, . .	25·7	29·3	27·4	90·3	0·19

PATHOLOGY.—*Malaria.*—The months of January, February, and March are, he says, the most unhealthy. The fevers are of the same character as those we have already described as prevailing along the coast. He observed uterine pains and hæmorrhages due to malarial fever, and curable by quinine.[1] The Ogobai river forms an alluvial delta in the neighbourhood of Cape Lopez, with a complicated network of creeks, swamps, and dense forests of mangroves and palms, which become inundated during the rains.

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[1] *Archiv. de méd. nav.* vol. xiv.

Du Chaillu describes two forms of malignant fever as met with in the Ogobai region. In the first form, the disease is ushered in by a slight chill, or chills, with loss of appetite and weakness. The real attack begins with fever, preceded or not by a chill, with jaundice, a haggard countenance, heavy perspiration, or a dry skin, vomiting, and prostration. The third attack is said to be commonly fatal. In the other form there is no jaundice; the countenance is pale, there is a peculiar ghastliness and wildness of expression, the skin is cold to the touch, although the patient does not complain of cold. The whole surface is almost insensible to stimulants, the pulse generally small and very frequent. In the last stage there is sometimes blindness and deafness, in others raving delirium. The patient may die in the cold stage without any reaction. Among the natives, this traveller says, the chills return every three or seven days for some weeks, and wear out of themselves. The natives rarely die of malignant fever, but this does happen occasionally.[1]

Typhoid Fever has been observed in the Gaboon by Dr. Dumay;[2] but it does not appear to be of frequent occurrence.

Dysentery, which is less common among the French at the present day than during the earlier period of the French occupation, is still to be looked upon as one of the diseases endemic in the country, the natives suffering largely both from dysentery and diarrhœa.

Acute affections of the respiratory organs are rare among the settlers, as Bestion had occasion to treat only two cases of pneumonia and one of bronchitis during his residence there; but the natives suffer from these diseases to a considerable extent.

Phthisis runs a rapid course to a fatal termination in the Gaboon.

Rheumatism is very common among the natives.

The country stretching between Cape Lopez and the Congo, although unhealthy, is upon the whole less affected with fever than the coasts we have just noticed, excepting at some particular spots where it attains considerable intensity.[3]

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[1] Du Chaillu, *Explorations and Adventures in Equatorial Africa*, London 1864.

[2] *Archiv. de méd. nav.* vol. xiv.

[3] At Loango pulmonary catarrhs affect the natives, especially during the dry season; *Pneumonia* and *broncho-pneumonia* are frequent, making great ravages amongst the intemperate; *Phthisis* is rather rare. *Smallpox* is a dreaded malady, but *Scarlet Fever* has not been observed. *Syphilis*, formerly rare, is now frequent, especially on the coasts. *Scrofula* is by no means rare; *Leprosy* is comparatively seldom met with. —*Archiv. de méd. nav.* 1889.

CHAPTER IX.

CONGO AND THE CONGO FREE STATE.

Geography and Climate.—The following particulars respecting the topography of the stations and climatology of the Congo are mainly derived from a special report prepared by the Government of the Free State at the instance of Lord Vivian, the British Ambassador in Brussels. The following are the stations occupied by the Free State, and their geographical positions:—

Banana, lat. 6° 1′ 20″ S. ; long. 12° 21′ 50″ E.
Boma, lat. 5° 46′ 37″ S. ; long. 13° 10′ 7″ E.
Matadi, opposite Vivi on the left bank of the Congo.
Vivi, lat. 5° 40′ S. ; long. 13° 49′ E.
Lukungu, to the S.S.W., and about 30 kilometres from Manyanga.
Manyanga, lat. 4° 53′ 30″ S. ; long. 14° 22′ 54″ E.
Leopoldville, lat. 4° 20′ S. ; long. 15° 25′ E.
Bangala, lat. 1° 33′ N. ; long. 18° 45′ E.
Stanley Falls, lat. 0° 15′ N. ; long. 25° 25′ E.
Loulouaburg, lat. 5° 58′ S. ; long. 22° 49′ E.

These positions cannot yet be accepted as perfectly exact. All the stations above mentioned are established on the banks of the Congo except Lukungu, which is situated on the river of the same name at a distance of about 20 kilometres from the Congo, and Loulouaburg, which is built near to the Louloua, an affluent of the Kassia.

The station of Banana is placed on a sandbank, projecting between the sea and the mouth of the Congo. In its environs there exist some mangrove marshes.

At Boma the country is elevated and steep. No marshes exist in its neighbourhood, except in some spots on the banks of the river, which are flooded when the water is high.

The stations of Vivi and Matadi are built at the foot of hills, at the spot where the navigation of the Lower Congo ends. The current here is very rapid. No marshes exist in their vicinity.

The following table gives the *resumé* of the meteorological observations taken at Vivi, 114 mètres altitude:—

Months.	Mean Temperature, part of 1882–83.	Mean Maximum.	Mean Minimum.	Mean Variation.	Maximum Variation.	Velocity of Wind, per diem per mile.	Number of Squalls per Month.	Intensity of Rainfall, Mean Amount which fell on Rainy Days. mm.
January, . .	25·8	29·5	22·5	7·0	11·1	101·6 (1881)	11 (1883)	8·3 (1883)
February, .	26·4	31·5	22·5	9·0	14·8	84·4	12	4·4
March, . .	26·2	30·9	22·8	8·1	12·8	90·4	14	13·0
April, . .	25·9	31·3	22·6	8·7	14·0	wanting	19	14·4
May, . .	24·9	29·9	22·2	7·9	14·8	wanting	6 (1882)	8·4
June, . .	22·2	27·0	19·4	7·6	14·6	131·1 (1880)	0	...
July, . .	20·7	26·2	17·7	8·9	15·8	116·6	0	...
August, . .	21·4	26·6	16·8	8·8	16·4	163·5	0	...
September, .	24·0	27·9	20·6	7·3	12·4	172·1	0	0·3 (1882)
October, . .	25·2	29·6	21·9	7·7	13·7	197·6	0	3·2
November, .	25·9	31·1	22·5	8·6	15·7	101·9	21	14·4
December, .	25·5	29·1	22·9	6·4	11·8	78·7	12	22·7

Temperature of the soil, 24°–26°.
Temperature of the Congo, 24°·6–28°·9.
Dry season, June to October.

The maximum humidity of the air occurs in December.
The minimum in July and August.
Winds generally from S.W.; in the rainy season from the W., with frequent calms.

At Vivi, the heavy rains are almost always accompanied by electric phenomena.

Lukungu is built on a pretty high hill, near to the river of the same name, which here runs rapidly in a narrow bed. The country around is very steep, so that no trace of stagnant water is to be found.

Manyanga (South) is situated on a sandbank on the Congo, in a mountainous country. It is placed opposite the mouth of the River M'pioki, which at low water leaves a small marsh.

The station of Leopoldville, the most important on the Congo, is situated on the lower part, and at the base, of a hill—Mount Leopold—on the shores of Stanley Pool. The surrounding country is flat. There are no marshes in the immediate environs of the town, but at the distance of some kilomètres, not far from Kinshassa, there is a marshy plain of considerable extent. The house in the town which has the highest elevation is placed on the summit of Mount Leopold, about 70 mètres above the level of the Congo. The other houses and stores form two terraces upon the side facing the north-east. The town is built upon a soil of recent formation, covered, in the valley, by a deep layer of alluvium. The vegetation of the heights consists of small trees and shrubs. The valley, where not cultivated, is covered with wood and brush. The town has a good water-supply. The subjoined table, prepared by Dr. Mense,[1] gives us valuable information respecting the meteorology, monthly distribution of fevers, and the rise and fall of the river at this station:—

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[1] *Rapport sur l'état sanit. de Léopoldville, de Nov.* 1885 *à Mar.* 1887, Brux. n. d.

		Level of the Congo.	Fevers among the Europeans.[1]	Temperature (Centigrade).					Rainfall.	Number of Squalls.
				Maximum.		Minimum.		Absolute Variation.		
				Highest.	Lowest.	Highest.	Lowest.			
1885	Dec.	High (comenced to fall the 24th)	100%	...	...	...	...	...	...	7
1886	Jan.	Falling, ...	125%	...	...	...	...	...	...	7
	Feb.	Low (commenced to rise), .	81%	...	...	...	...	...	...	10
	Mar.	Highest level, . . .	92%	34·0	...	...	...	...	178 mm.	9
	April	High, ...	54%	36·1	28·7	23·2	19·9	16·2	254 mm.	17
	May	Falling, ...	50%	33·8	27·9	22·5	19·5	14·3	133 mm.	9
	June	Falling, ...	50%	33·3	25·8	21·6	16·7	16·6	2 hvy. shwrs.	2
	July	Low, ...	61%	30·3	23·1	20·2	15·8	14·5	2 lght. shwrs.	0
	Aug.	Lowest level (commenced to rise the 12th)	17%	32·8	25·2	20·6	16·8	16·0	light rain	0
	Sept.	Rising, ...	52%	35·0	26·1	21·9	16·1	18·9	71 mm.	3
	Oct.	High, still rising, . .	50%	34·9	26·9	23·3	18·3	16·6	130 mm.	8
	Nov.	High, ...	80%	35·3	26·1	23·0	18·9	16·4	239 mm.	8
	Dec.	High, ...	77%	...	...	...	18·9	...	132 mm.	11
1887	Jan.	Falling rapidly, . . .	63%	35·4	23·2	22·2	19·1	16·3	186 mm.	7
	Feb.	Low, ...	91%	35·4	28·3	23·0	18·1	17·3	89 mm.	6

The station of Bangala is situated in a district only slightly raised above the level of the river, covered with a rich vegetation, and surrounded by numerous marshes giving off malarious emanations. The drinking water is rich in organic and mineral matters.

Here, according to Captain Coquilhat's observations, no dry season, properly speaking, exists. The months when the fall is least are December, January, and February. April, May, and June are months of abundant rainfall. April corresponds to the flood of the Congo.

The following table gives the number of rainy days and the number of hours of rainfall for each month as observed by Coquilhat. These figures must be regarded as only approximative :—

	1884.								1885.						
	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.
Number of Rainy Days,	10	9	6	7	6	8	8	7	8	4	11	13	10	12	15
Number of Hours of Rainfall,	34	27	28	27	24	25	24	15	16	9	27	43	28	35	28

Sometimes it rains for many consecutive days, at other times there are intervals of two to nine days between the different falls. Sometimes the rains are preceded by dull cloudy weather, at other times they follow sudden clouding of the sky. Squalls are frequent, and generally come from N.E. or S.E.

The night dews are abundant. There is no striking change in the character of the vegetation at any season; the air is always humid, and the soil always more or less moist.

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[1] The numbers indicate the attacks, mild or severe, occurring monthly per 100 of the European residents.

The months of January and February are the warmest, the temperature then rises to 34° or 35° C. June and July are the coldest months, when the thermometer sinks to 30° or 27°.

The temperature of the other months at 1 p.m. is about 32°. The thermometer never falls below 21°, and this minimum is quite abnormal. The Congo reaches its lowest level here in January, rises in May, falls again in October, and rises again in December.

I have not met with any topographical account of the other stations belonging to the Free State and other nationalities on the Congo.

PATHOLOGY.—*Malarial Fever.*—The Congo basin is by no means exempt from the diseases usually met with in tropical and subtropical Africa. In Tuckey's expedition to the Congo, in July 1816, out of a crew of 54 men, 19 died of remittents and intermittents, a mortality of 35·2 per cent. in the space of three months. This disastrous result gave rise perhaps to an exaggerated estimate of the insalubrity of the country. Recent experience, however, proves that the banks of the river and the whole region through which it flows are more or less subject to endemic disease. Malaria reigns everywhere, and, as Mense says, "despite of its name of 'Marsh Fever,' it is met with in districts where no marshes exist."

Malarial fever is not only generally diffused over this region, but manifests a considerable degree of intensity. This is proved by the experience of the Baptist Missionary Society, which began to occupy the Congo in 1878. From that date up to August 1888, this Society had sent out 53 agents, of whom 17 had during that period succumbed to climatic influence; 3 had returned to England hopelessly invalided; 4 had retired from other causes not connected with their health; and in August 1888, 6 were at home on sick leave. In short, during a period of eleven years, 31 per cent. had died, and 6 per cent. had suffered so severely as to be unfit to return to Africa. Yet these were men carefully selected, in the prime of life, and men of regular habits, placed in fairly comfortable circumstances. The posts occupied by the Society are the following:—

Underhill, between Boma and Vivi, in lat. 5° 10′ S.; Wathen, in lat. 4° 40′ S.; San Salvador, in lat. 6° 20′ S.; Stanley Pool, in lat. 4° 20′ S. At all these stations considerable losses were sustained. Some stations, not named, situated in 5° 0′ S., have proved so unhealthy that they have been abandoned. No fatal cases had occurred at Bolobo, in 2° 30′ S., or at Lukolela; but these had only been occupied since 1884.

The stations situated immediately along the coast have been found to be less malarious than some of the inland ones. Underhill, between Boma and Vivi, is noted for the number and gravity of the cases of fever which are there observed. At Vivi fevers are numerous and fatal. Manyanga (North), at a comparatively high elevation, is extremely unhealthy. At Leopoldville mild attacks of fever are frequent; the bilious remittent and melanuric forms are comparatively rare.

Mense says that at Stanley Falls and Bangala fevers are less frequent than on the Lower Congo. The results of the recent expedition of Stanley through the country stretching from Yambuya on the Aruwimi to the Albert Nyanza, cannot be regarded as very decisive as to the health of this region of swamp and forest, inasmuch as the men, who had probably already suffered from malarious disease, were subjected to much hardship and want of food.

It is not to be overlooked that many of the attacks from which the expedition suffered were probably of the nature of relapses of fevers contracted on the lower stretches of the country through which they passed. Still, his experiences deserve to be recorded. He says: "On the plateau of Kavalli and Undussuma, Jephson, Parke, and myself were successively prostrated by fever, and the average level of the land was 4500 feet above the sea. On descending to the Nyanza plain, 2500 feet lower, we were again laid up with fever attacks. At Banana Point, which is at the sea-level, ague is only too common. At Boma, 80 feet higher, the ague is more common still. At Vivi there were more cases than elsewhere, and the station was about 250 feet higher than Boma, and not a swamp was near it. At Stanley Pool, about 1100 feet above sea-level, fever of a pernicious form was prevalent. While ascending the Congo with the wind astern, we were unusually exempted from ague; but descending the Upper Congo, facing the wind, we were smitten with the most severe form of it. While ascending the Aruwimi we seldom thought of African fever, but descending it in canoes, meeting the wind currents, we were speedily made aware that acclimatisation is slow."[1]

Stanley found a screen of trees to be a protection against all but the local malaria, and mentions the fact that Emin Pasha looks upon a mosquitoe net as a safeguard against malaria. Cold winds determine paroxysms in those already infected. It does not necessarily follow, however, that the winds carry the infection. The cooler, keener air of the elevated plateaux of Kavalli and Undussuma may, in the case of these travellers, have brought on attacks of ague, and yet these heights may after all prove to be salubrious. The expedition carried the infection with it. The lower temperature and cold winds, which to those not affected with malaria would have been health-giving, determined in the worn-out, ague-stricken travellers the dangercus relapses that are often observed in those who return to England from a malarious country.

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[1] Stanley, *Darkest Africa*, London 1890.

We have thus to distinguish a central zone, in which malaria is most severe. The traders stationed in the delta at Banana, Boma, and Mukimvika, and on the coast near the river at Cabuida, Landana, and Loango, enjoy fair health. In the region extending from Vivi to Stanley Pool, on the other hand, some 200 Europeans have been living for the past six years, of whom 25 per cent. are stated to have died annually from fever. Above Stanley Pool, again, the country appears to be somewhat more healthy.

Localities exposed to high winds and sudden changes of temperature are observed to be most subject to fever. Dr. Mense observed that at Leopoldville[1] the worst cases occurred in the house situated on the exposed summit of Mount Leopold. It had at last to be abandoned. He is also inclined to connect the extraordinary morbidity and mortality of Manyanga (North) with its elevated site. At Vivi, situated in the neck of a mountain funnel, and much exposed to the high winds, he observed more grave cases of malaria in three months than during his prolonged stay at Leopoldville.

Stanley also lays great stress upon the marked unhealthiness of those stations exposed to cold blasts of wind. "The body," he says, "is perpetually subjected to violent changes of temperature, one minute in a state of profuse perspiration, and the other minute, out of doors without additional clothing, exposed to a chilling blast that closes the pores and chills the damp flannel pressed against the body."

From this it is not, however, to be inferred that low, shut-in valleys, where air cannot circulate, are to be chosen as the sites of habitations, but rather that situations well raised, so as to allow free drainage, at a distance from marshes, and at the same time protected from the prevailing winds, should be selected in preference to localities specially exposed to every vicissitude of weather.

No connection has been traced between the prevalence of fever and the level of the water of the Congo at Leopoldville.

Personal habits and hygiene have an important influence on the health of residents on the Congo. Mense says that, in contradiction to theoretic principles, he has found that the health of persons who have to perform heavy bodily work is generally satisfactory, "and very often these labourers do not take any precaution to protect themselves from the sun's rays;" but he adds, "it is certain that in many persons physical exertion provokes grave fevers." For some persons pretty severe exercise appears to be a hygienic necessity; in others, the resulting fatigue exposes the body to the inroads of disease. The experience of almost all who have resided long in tropical countries, and especially of those who have lived on the Congo, has led them to dwell on the extreme danger of direct exposure to the sun's rays—particularly when employed on fatiguing work or on exhausting marches—that I have thought it right to record the experience of a qualified observer on the other side. The truth is that physical exertion, proportioned to the constitution and habits of the individual, is as necessary to health in the tropics as elsewhere. The amount that may prove beneficial varies in different cases. The men who have been accustomed for years to unload vessels, probably do not suffer from this work, and they may even enjoy better health than those who lead a sedentary life on shore; but it cannot be doubted that over-exertion and exposure to the sun's rays are doubly dangerous in a tropical and malarious country.

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[1] Mense, *Op. cit.*

Stanley has reason on his side when he urges the necessity, above all, of protecting the head from the sun. His remark, that "the sun is the only real enemy of the European" in the tropics, may be accepted as a safe principle to work by.

Danckelman[1] puts the matter in its true light when he says: "The pernicious effect of a too long exposure to the tropical sun is so evident, that it has often been wrongly considered as the cause of fever; but there are tropical countries where fever is unknown, and on board ship the sailors expose themselves to the sun without fear. At any rate, if you are compelled to be long exposed to the sun, avoid at the same time engaging in fatiguing work or violent exercise; otherwise you are certain to have an attack of fever."

The danger of disturbance of the soil is probably as great on the Congo as in other fever regions. The only case of hæmaturic fever seen by Mense in Leopoldville was in the person of the agriculturist whose duties especially exposed him to the emanations from the soil. Mental depression or shock as well as *ennui* are observed to predispose to attacks and to increase their gravity. Intemperance in eating and drinking, especially the latter, is a powerful predisposing cause of febrile attacks and organic disease.

The only place for which we have a record of the monthly distribution of fevers is Leopoldville. Here the rainy season lasts from October to May; the dry season from June to September.

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[1] *Le climat du Congo*, Brux. 1885.

Reckoning upon the figures in the table already given, extending from December 1885 to February 1887, the average monthly percentage of fever cases in the rainy season (taking the period March 1886 to July 1887) is 69·6, and that in the dry season is 45·0; the worst months appear to be November, December, January, and February, when the temperature is high. The healthiest month appears to be August, when the dry weather has already lasted for two months and the temperature is still comparatively low. All that can be said is, that the cold and dry months are less feverish than the warm and wet months. The data are insufficient to enable us to give any more definite statement respecting the influence of the meteorological elements upon the development of malaria on the Congo.

The fevers met with in this region are—1. Simple intermittent fever of the various types; 2. Bilious remittent; 3. Hæmaturic fever. In the bilious remittent the cold stage is generally absent; the fever is ardent and continuous, with great headache, pains all over the body, especially in the joints, severe and continued vomiting, and great prostration. In the gravest cases, jaundice occurs, and delirium and loss of consciousness may supervene. In all cases the fever is followed by great weakness. In the majority of instances, however, the fever is mild, showing no dangerous symptoms, causing little uneasiness to the patient, perhaps not even preventing him from following his usual occupations. But none the less is it silently and surely affecting the constitution of the victim, inducing a cachexia, marked by anæmia and enlargement of the spleen and liver. Hæmorrhages from different organs are, according to Stanley, a frequent complication of the pernicious fever of the Congo.[1] Mense found small clots in the urine of those who had experienced severe rigors.

A form of dry colic similar in its symptoms to lead colic, but which cannot be traced to this poison, has been observed in Europeans on board the Government steamers. Sporadic cases of this disease have also, it is said, been met with in different regions of the Congo. This is regarded by Mense as a special form of malarial poisoning, but I think that this view is somewhat doubtful. The natives of the Congo valley suffer from malaria, but less frequently and severely than the Europeans. They sometimes exhibit the malarial cachexia. The natives of Accra, on the Gold Coast, who take up their residence on the Congo, suffer more from fever than do the aborigines.

Typhoid Fever does not appear to be known on the Congo, but Mense states that bilious fever occasionally assumes a typhoid form, similar to what is spoken of as typho-malarial fever.

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[1] Roberts, *Remarks on the Preservation of Health on the Congo*, London 1885.

Yellow Fever is unknown on the Congo basin.

Dysentery is met with throughout all the Congo valley. From Boma to Stanley Pool it appears only sporadically. Leopoldville, with its good water-supply, is free from the disease. Stanley Falls and Bangalas, although comparatively free from malaria, are severely affected with dysentery. Dysentery, affecting chiefly the negroes, is endemic in a severe form in the Upper Congo and throughout the forest region.

Hyperæmia and enlargement of the *liver* and *spleen* are frequently met with as results of fever. Abscess of the liver is seldom observed except as a sequel of dysentery.

I have met with no accounts of the existence of *Scarlet Fever* in this region. *Measles* prevails on the west coast, and probably extends to the Congo. *Smallpox* occurs among the native tribes in destructive epidemies, extending all over the country. *Mumps* broke out among the Zanzibaris of Stanley's expedition in the forest.

Pulmonary Diseases.—Europeans suffer little from this class of complaints; but, according to Mense, they occur with great frequency among the negro races. Pneumonia and pleurisy in particular appear to be rather rare at Leopoldville, but these affections are very common at Vivi. The reason of this difference, according to Mense, is that the labourers on the latter station dwell in a village situated on a hill exposed to all the winds, while at Leopoldville the dwellings of the workmen are placed in a valley. At Boma, near the sea, diseases of the respiratory organs are more common than at Leopoldville.

Phthisis is not at all uncommon among the natives.

Acute Articular Rheumatism is observed to be more common in the valley of Leopoldville than on the dry heights of Vivi; and at the former station the affection is often accompanied by grave complications. The Anchylostoma duodenalis is common among the native races, producing its usual symptoms.

Beriberi does not appear to be endemic in the Upper Congo region, but is said to cause great ravages among the Krooboys employed on the Lower Congo. *Guinea-worm* is said not to have been originally endemic in the Congo territory, but to have been imported from the Gold Coast. Be this as it may, Stanley's followers suffered from it in the country between the Upper Congo and the lakes.

Leprosy prevails in the Congo, both among the natives and the labourers from other districts in the service of Europeans.

Frambœsia is very common among the negro children. *Ulcers*, especially of the inferior extremities, are extremely common among the resident population, and they proved one of the most severe scourges of Stanley's expedition.

The *Sleeping Sickness*, here known as the *Ntansi*, makes numerous victims on the Congo State, notably at San Salvador. It mostly affects the male sex about the age of puberty.

ANGOLA, BENGUELA, MOSSAMEDES.

The Angola country, lying to the south of the Congo, differs little as respects salubrity from the coast districts of the Congo itself. St. Paul de Loanda, the capital of Angola, is situated on a dry barren tract of land. The rainfall is scanty. The first period of rains extends from October to December. January and February are dry months. The second rainy season extends from March to May; and the long dry season from June to October. Nearly all the water used in the town is carried from the River Bengo. The night-soil is thrown upon the shore, where it is exposed to the sun. This is the cause to which Danckelman ascribes the frequent outbreaks of fever in the town. The most unhealthy months are said to be September, October, January, and May. Dysentery is very common at Loanda. The Coanza river (in its lower course) and its tributaries are unhealthy. When, however, we reach the first plateau the climate improves. Fevers are comparatively seldom met with in Cazengo, Pungo-Andongo, Gulungo-Alto, and Ambaca. The climate of Malange is almost European in character, wheat growing well; fever and liver diseases are not unknown.[1]

BENGUELA is well watered by numerous rivers, and in the low lands water is generally found near the surface. The capital, named Benguela, in lat. 12° 33′ S., at the mouth of the Catumbella river, is swampy and unhealthy.

MOSSAMEDES is, upon the whole, healthy, although near the town there are some marshy localities mentioned by Canolle[2] where fevers prevail. Danckelman states that when the town was founded in 1840, fever was unknown, and this immunity continued for the first ten years, after which fever began to show itself little by little with the progressive pollution of the soil.

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[1] Alexanderson "On the River Quanza," July, *R.G.S.* 1876, p. 429.

[2] *Archiv. de méd. nav.* Jan. 1888.

CHAPTER X.

SOUTH AFRICA.—THE CAPE, NATAL, TRANSVAAL, ETC.

GEOGRAPHY AND CLIMATE.—Cape Colony includes the whole country south of British Basutoland and the Free State on the east, and of the Orange River on the west. It is washed by the Indian Ocean on the east, and by the Atlantic on the west. The total area is given at 213,917 square miles, with a population, in 1887, of 1,377,213. The Cape Colony forms the southern part of the African table-land, rising in terraces, having altitudes of 1800 feet at Grahamston, in the east; of 2500 feet at Graaf Reinet, in the east centre; of 3200 feet at Springbok, in the west of Namaqualand; and of 4042 feet at Kimberley, in the north.

The following table gives the temperature and rainfall of the coast, of the midland, and of the elevated regions of the interior. It may be remarked that the rainfall on the north-west coast is extremely scanty, varying at Port Nolloth, for example, from 1·39 to 3 inches annually. At Kimberley, in the north interior, the average rainfall from 1884–87 was 15·6 inches.

Coast.		Mean Temperature.	Mean of Maxima.	Mean of Minima.	Mean Range.	Rain.
Wynberg, near Cape-town, . . .	Summer,	63·8	76·2	65·2	11·0	34·62
	Winter,	53·3	66·4	49·2	17·2	
Port Elizabeth, East Coast, Midland, .	Summer,	66·8	75·0	60·4	14·6	19·99
	Winter,	59·5	67·4	53·3	14·1	
Grahamstown, South-East, alt. 1800 feet, .	Summer,	63·1	74·3	56·6	17·7	29·59
	Winter,	53·1	63·7	50·9	12·8	
Elevated Plateau, Aliwal North, alt. 4330 feet,	Summer,	67·4	88·2	55·8	34·4	22·86
	Winter,	48·4	62·6	38·4	34·2	

PATHOLOGY.—*Malaria.*—Malarial fevers can scarcely be said to form any part of the pathology of Cape Colony. During the four years 1884, 1886, 1887, and 1888,[1] there were 27,441 admissions into the colonial hospitals for all diseases, and 3635 deaths. Of these, ague was the cause of 144 admissions and 4 deaths. The admissions for ague thus formed 5·2 per 1000 of the total treated, and the deaths were in the proportion of 1·1 per 1000 of the deaths from all causes. The total admissions for remittent fever were 17 during the four years, with one death. Most of the cases of ague and of remittent fever occurred at Cape Town, Port Elizabeth, and at Graaf Reinet, the last-mentioned being an important point on the route from Port Elizabeth into the interior. A few cases occurred at Kimberley, whither people from all parts of the world were attracted to try their fortunes at the diamond fields. It is thus doubtful whether any appreciable proportion of the cases treated in the hospitals were contracted in South Africa. No deaths from paroxysmal fevers occurred among the troops from 1879 to 1883.

Enteric Fever is by no means rare in Cape Colony. During the four years with which we are dealing, the admissions ascribed to this cause were 949, and the deaths 271. It thus formed 34·6 per 1000 of the admissions, and 74·5 per 1000 of the total deaths. But in addition to enteric fever we meet in the returns of 1884, 1886, and 1887 with numerous admissions and deaths from what is termed "simple continued and camp fevers." In the returns of 1888, what is, no doubt, the same disease, is styled simple continued fever. The admissions for this form of fever during the four years were far in excess of those for all other fevers combined, and although the deaths form a smaller proportion to the cases treated than in enteric fever, yet this "simple continued fever" is, as regards total mortality, the most fatal fever in the Colony. The admissions for simple continued fever numbered 3102, and the deaths 418, or a proportion of 113·3 of the total admissions, and 115·0 of the total deaths. The deaths in 1890 from this fever were comparatively few. This disease, therefore, plays an important *rôle* in the pathology of South Africa, giving rise in a series of years to considerably more than one-tenth of the total deaths occurring in hospital.

What is the nature of this fever? Is it malarious? is it a mild form of enteric fever? or is it a distinct disease? We observe from the returns, that it is most common in Cape Town and Kimberley. It is thus probably more common in towns than in the country, and this is so far in favour of the view that it is etiologically allied to enteric rather than to the malarious class of fevers. We meet with accounts of fevers in South Africa of the so-called typho-malarial type, occurring in localities where the commonly assumed causes of typhoid fever are believed to be absent, and in which some of the symptoms of ordinary typhoid were wanting or modified. As it is possible that the simple continued fever of the Cape is of the same nature, we shall give a condensed account of the fever observed by Woolfryes during the Galeaka-Gaika war in 1877–78, on the north-east frontier of the Colony near to the Kei river, and that met with by Faught in the Bechuana Field Force in 1884.

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[1] The returns for 1885 are defective, and cannot be used.

Dr. Woolfryes states that in April the troops underwent great fatigue, privations, and hardships, were exposed to excessive heat of the sun by day and to chilling thunderstorms at night when bivouacked out, yet the health of the men did not suffer to any great extent. As winter approached, the nights became cold, the dews very heavy, and the alternations of temperature sudden and most trying. As May advanced, enteric fever began to assume a more serious type. No place was free from it. The troops quartered on Buffalo heights suffered as well as those stationed at the posts below; and it appeared to make no difference whether the drinking water was from river or spring. No local cause of the fever could be discovered. It appears, indeed, in the first instance to have been imported from outside sources, but it does not seem to have been kept up and disseminated by contagion. This fever was designated variously as enteric, malarious enteric, and typho-malarial. Its peculiarities were, the frequent presence of a dusky discoloration of the skin, frequency of coma and stupor, suffusion of the eyes and face; the presence of rashes, other than the rose-coloured lenticular spots of typhoid, the frequent absence of diarrhœa, and the frequency of sore throat, with little to be seen on examination but some congestion of the follicles at the back of the pharynx. The autopsy generally revealed patches of congestion in the stomach and more continuous congestion of the duodenum, in addition to the usual lesions of enteric fever. It is noticed that 80 per cent. of those admitted to King William's Town Hospital were under twenty-five years of age.

In the Bechuana Field Force, Faught remarks that at Langford, 12 miles from the termination of the railway at Orange River, the temperature at the beginning of January rose to 112° in double tents, but the men continued in good health, and sunstroke was unknown. The force then moved to Barkly Camp, on a bend of the Vaal river, at a considerable distance from the town. About the 25th of January the troops began to leave Barkly for Taungs. The water-supply at all the camps was good. The diseases from which the troops suffered were few—principally fevers of a low type, which, according to Faught, were of malarial origin, frequently complicated with internal congestion and enteric lesions. It often began as a simple continued or remittent fever, and sometimes ended in ague. This fever is said to appear here during the late rains, and to disappear when the cold weather sets in. In one case it is stated that after death the ulcers in the small intestines were perfectly healed, but the liver and spleen were greatly enlarged. No case of fever with this lesion was seen below, that is, south of Taungs. No native follower suffered from fever with enteric lesion. The Dragoons, who had suffered severely from fever in Natal, had not one case of fever in which this lesion was even suspected to exist. The First Mounted Rifles, recently from England, consisting of young men, suffered most. This fever increases in severity towards the north. March, April, and May are the months in which it is most common. Dysentery caused only one death.

We thus observe a complete absence from the pathology of the Cape of intermittent and remittent fevers, of the malarial cachexia with enlargement of the spleen, and of anæmia. On the other hand, along with enteric fever, which is rather common, a form of continued fever is seen to be prevalent and by no means free from danger. About one in eight of the cases of this disease admitted into hospital proves fatal. On the north-eastern frontier we meet with a fever of a low type, attacking chiefly the young and the non-acclimatised, marked by a tendency to stupor; not traced as a rule to polluted air or water; characterised by skin eruptions different from what are seen in typical typhoid; diarrhœa is frequently absent. Congestion of the duodenum, in addition to ulceration of Peyer's patches, are its most distinctive pathological lesions. In Bechuanaland, the fever met by Faught presented distinct enteric lesions, but could not be traced to any specific cause. Its course was not that which typhoid fever is expected to take. It often seemed to begin as a remittent and end as an ague. It was supposed to be limited to the warmer region north of Taungs, it was autumnal in its prevalence, it spared the native, and it pressed with special severity upon the young recruit newly arrived from England. Such are the facts, apart from all theory. We cannot help asking the question, whether the fever noticed by Faught in Bechuanaland is not the same as that which attacks young soldiers in India and Algeria, and whether the fever seen by Woolfreys in the region of the Kei river is not etiologically related to that designated simple continued fever in the returns given above? In short, it is highly probable that all these fevers are typhoid and not malarial. An epidemic fever occurred in Cape Town and various other localities of the Colony in 1867. It was variously supposed to be typhus, typhoid, and irregular remittent, but its real nature cannot be now determined.

Typhus.—It is doubtful if typhus fever is ever met with in any part of South Africa. Some rare cases, supposed to be typhus, have, it is true, been observed, but their extreme rarity is itself presumptive of mistaken diagnosis.

Diphtheria.—Limited outbreaks of diphtheria occur from time to time in different parts of the Colony, and wider epidemics have been occasionally observed, such as that which occurred in Kaffraria in 1866, an account of which has been given by Lawson.[1] Diphtheria was the cause of 0·8 per 1000 of the hospital admissions, and of 2·3 of the deaths, in 1890.

Smallpox is not endemic in South Africa. It is said to have been introduced into the Colony in the eighteenth century, and its reappearances since that time have usually been traced to importations from abroad. It was entirely absent from the Cape from 1812 to 1840. A severe outbreak occurred in Cape Town and its vicinity in 1882.

Measles, like smallpox, is not indigenous to South Africa, for the early history of the Colony records long periods during which no case of the disease was observed. When it has broken out after having been absent for a long time, as in 1812, it has usually assumed a severe type, and has given rise to a high mortality.

Scarlet Fever is seldom seen. No case of the disease was admitted into any of the hospitals in 1890.

Asiatic Cholera has never visited any part of Africa south of Cape Delgado, in lat. 11° S.

Dysentery and *Diarrhœa* occupy a somewhat prominent place in the pathology of the Cape. The proportion which deaths from dysentery bears to the total hospital mortality varies in different years from 25 to 40 per 1000. The troops formerly suffered more from diarrhœal diseases than they do at the present day, but this was probably owing to the frequent wars. The native races are more liable to these complaints than the colonists. Dysentery is most prevalent during the autumn, and diarrhœa in summer.

Respiratory Diseases, as a class, are comparatively rare in the Cape. The admission-rate among the troops, for the three years 1886–88, was 18·3, and the death-rate, 0·80, as against an admission-rate in the United Kingdom, for the same period, of 66·1, and a death-rate of 1·41 per 1000. *Bronchitis* gives rise to about 20 per 1000 of the hospital admissions, and to 18 per 1000 of the hospital deaths. *Pneumonia,* on the other hand, accounted for 32 per 1000 of the admissions, and 114 per 1000 of the deaths in 1890, proportions very similar to those observed during the four years 1884, 1886, 1887, and 1888. The proportion of cases of pneumonia to the total treated by Egan in Kaffraria was 31·3, so that we may take this as representing pretty fairly the comparative prevalence of the disease in the Colony. *Pleurisy,* in 1890, formed 5 per 1000 of the admissions, and 7 per 1000 of the hospital deaths. From this it may be inferred that bronchitis is rare and mild in the Cape, while pneumonia and pleurisy are probably quite as common as in other parts of the world.

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[1] *Trans. Epidem. Soc.* 1869.

Phthisis.—It is very much to be regretted that we have no reliable statistics of the mortality from phthisis in the different districts of Cape Colony, and of the incidence of the disease on the different races. Such statistics would have been of special value in reference to the etiology of phthisis. It is generally stated that phthisis is more frequent along the coast than in the interior, and this is probably correct. We shall afterwards see that it is almost unknown in Bechuanaland, and it is said to be seldom seen in Basutoland or in the Free State. Hirsch affirms that the Hottentots inhabiting the plains nearest the coast are specially liable to suffer from consumption, but this may probably have been owing not to race proclivities, or to climate, but to their conditions of life. Whatever may be the precise distribution of the disease as regards locality or its relation to race, consumption takes no insignificant place among the fatal diseases of the Colony.

Pulmonary phthisis caused 44 per 1000 of the total deaths occurring in the public hospitals in 1890, and in addition to this 128 per 1000 were ascribed to pneumonic phthisis, which gives a proportion of 172 per 1000 of the deaths as due to destructive lung diseases. In other words, about one death in six occurring in the hospitals is caused by consumption. If we assume that phthisis is rare in the interior, it follows that it is rather of frequent occurrence in the coast districts. The excess of phthisis on the coast as compared with the interior is not entirely to be ascribed to climate or altitude,—although the importance of the latter as a factor in determining a low prevalence of consumption has been pretty well established by observations in this and other countries,—but it is, perhaps, largely owing to the difference in the social condition and employments of the people in the two regions. The larger trading towns, with their overcrowding and comparative poverty, are situated along the coast, while the population in the interior is sparse, and pastoral or agricultural. We may be quite sure that were large manufacturing or mining towns to grow up in the interior, consumption would be much more common than it is at present.

Other things being equal, consumption will be less common in a country in proportion as the climate permits and invites out-of-doors life, just as those who follow occupations which are carried on in the open air, such as fishing and agriculture, are everywhere least liable to phthisis. A warm climate or a cold climate, and even a low or a high altitude, are of secondary importance to purity of breathing air. There is a tendency to ascribe some occult influence to climate in relation to the prevalence of consumption, which it does not possess. The sparseness of the population of the interior, their comfortable circumstances in respect to food, clothing, and shelter, and the agricultural and pastoral employments which they follow, appear to me to be the principal circumstances to which the comparative freedom from phthisis, which the inland districts of the Colony enjoy as compared with the coast, is due. But it is none the less true that the dry, sunny, bracing air, which tempts to life out of doors, combined with the elevation, renders the interior of South Africa specially adapted as a residence for those who have a consumptive tendency.

Rheumatism.—The Cape, according to Parkes, has always been noted for the numerous cases of muscular rheumatism occurring amongst the troops; but articular rheumatism is not particularly common; nevertheless cardiac disease is more prevalent at the Cape than at any other station occupied by the British troops. The average mortality from diseases of the circulatory organs in the Colony is 1·91 per 1000, compared with 0·93 at home. It is to be noted that the station which ranks next to the Cape is Australia, which has a somewhat similar climate; while Malta, Mauritius, and Jamaica are remarkably free from this class of affections.

Referring to the hospital returns for 1890, we find that 30·5 per 1000 of the admissions were for rheumatism, and 7·7 per 1000 for rheumatic fever.

The deaths from these diseases bore to the total deaths the proportion of 1·1 and 2·3 per 1000 respectively.

Syphilis, so far as can be judged from the military returns, is pretty widely diffused throughout all parts of the Colony, but it is rarer in the more remote districts.

Leprosy is met with among the coloured races, but it is not very prevalent. There were 88 lepers interned in Robben Island in Table Bay in 1887. Considerable numbers are met with in other localities, both coast and inland. Assuming that for one leper interned in Robben Island there are three outside, this would only give about 2·7 lepers per 10,000 of the population.

Scrofula is stated by Hirsch to be widely prevalent among the Kaffirs and Hottentots, and to be of common occurrence among the Dutch colonists. I cannot say that I saw much of the disease during my residence in the Cape, but it must be somewhat common, seeing that it caused 6 per 1000 of the admissions, and 5 per 1000 of the total deaths, in hospital in 1890, for only very severe cases would be admitted to hospital.

Diabetes is known, but it does not seem to be of frequent occurrence in the Colony.

NATAL AND ZULULAND.

Geography and Climate.—The British Colony of Natal, on the south-east coast of Africa, lies between lat. 27° 15′ and 31° 23′ S., long. 28° 25′ and 31° 40′ E. It is bounded on the west by the Quathlamba or Drakenberg range; on the north and north-east by the Buffalo or Umzinyati, a tributary of the Tugela river; on the south by the Umtamfuna, and by the boundary line separating it from Kaffraria; and on the east and south-east by the Indian Ocean. Its greatest length is 280 miles, and its greatest breadth about 200 miles. Its area is estimated at 18,000 square miles, with a population of 481,361, of which 35,453 are white, the remainder being Zulu Kaffirs and a sprinkling of Indian coolies.

The country rises by three successive terraces from the shore towards the lofty mountains on the west, which attain a height of over 8000 feet, and are covered with snow for several months. The principal towns are Durban on the coast, and Pieter-Maritzburg in the interior. The temperature on the coast averages 76° in summer, and 55° in winter. The mean daily range at Durban is 18° 2′ F. At Pieter-Maritzburg, in the interior, the mean temperature of July, which is the coldest month, is 55°; that of February, the hottest, 80°·5 F.; and that of the whole year, 67° F.

Zululand stretches from Natal north to Delagoa Bay, and inland to the Drakenberg range, which separates it from the Transvaal. The principal rivers are the Tugela, on the Natal frontier; the Umvolosi, which falls into the sea at St. Lucia Bay; and the Maputa, which falls into Delagoa Bay. A chain of hills, commencing about 27° 30′, called the Lobombo Mountains, running parallel to the Drakenberg range, but nearer to the coast, divides the northern part of Zululand into two regions—a low, marshy, warm coast belt, and an elevated zone known as Zwaziland.

Pathology.—*Malaria.*—Intermittent fever is exceedingly rare in Natal, where it is only met with near the coast in humid localities.

The higher lands of the interior are non-malarious. Malarial diseases are not uncommon in the deep valleys of Zululand, but are most prevalent on the Lower Tugela,[1] at St. Lucia Bay, on the Black Umvolosi, and in the coast tract of Amatonga, from St. Lucia Lake up to Delagoa Bay. The higher lands of South Zululand are remarkably free from fever. During the late Zulu war, Ekow, situated some 30 miles inland, was found to be fairly healthy, but malarious fever occurred among the men employed in felling wood around the fort. Fort Chelmsford, too, furnished a considerable number of cases of fever, but whether it was malarious or typhoid in its nature is not quite certain. Zwaziland, to the north, is comparatively free from malarial disease.

Enteric Fever is far from rare in Natal. The troops stationed in the Colony have suffered severely from outbreaks of this disease at different times and in different localities.[2] Enteric fever furnishes a considerable number of admissions into the Civil Hospitals of the Colony.

Diphtheria is by no means rare in the Colony, and cases of *Croup* occasionally occur. The eruptive class of fevers—*Smallpox*, *Measles*, and *Scarlet Fever*—occupy a similar position in the pathology of Natal as in that of the Cape.

Dysentery is more prevalent in Natal than in Cape Colony, and the coast districts are apparently more affected than the interior. In Durban, out of 765 admissions for all diseases in 1889, there were 96 cases of dysentery. The total deaths were 116, of which 30, or rather more than one-fourth, were due to this disease. *Diarrhœa* is also frequent during the warm season.

Respiratory Diseases are comparatively rare—bronchitis especially so.

Phthisis is not common in any part of the Colony, but I am unable to say whether it is more common on the coast or interior.

TRANSVAAL.

The South African Republic, or the Transvaal, extends from the Vaal river, which separates it from the Orange River Free State in the south to the Limpopo, which is the boundary between it and the Matebele country on the north. On the east it is bounded by the Drakenberg Mountains, and on the west by Bechuanaland, from which it is separated by the Hart river, and by an irregular line connecting the head-waters of this river with the Notuane tributary of the Limpopo. Its area is estimated at 121,854 square miles, with a population of some 400,000, of which 80,000 are white, 299,749 natives, mostly Bechuanas, and about 30,000 white aliens.

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[1] *Report on the Health of the Navy*, 1879.

[2] Skeen, *Army Medical Report*, 1881. In the outbreak recorded by this author, there were 240 admissions and 41 deaths between November and February.

The country consists of elevated table-lands and undulating plains, having an elevation of from 4000 to 5000 feet, intersected by various ranges of mountains. Pretoria is the seat of government.

The winter season is dry and cold, particularly the nights. The days are often nearly as warm as in summer. The rainy season commences in September, but, as a rule, the heavy rains do not set in before December, and they usually end in March. The temperature is liable to sudden changes, which are said to give rise to catarrhal affections, especially among children.

Inflammatory Sore Throat, *Croup*, and *Diphtheria* are not at all uncommon. *Malarial Fever* is rare, but *Enteric Fever* is often very prevalent and fatal; indeed, it appears to be the most fatal endemic disease of the country.

Measles occurs in severe epidemics, but only at considerable intervals.

Diarrhœal Complaints and *Dysentery* are amongst the commonest diseases, and occur in the summer and autumn.

Phthisis is seldom seen.

Leprosy is met with among the natives; and it is said that cases are also known among the white population.

MATEBELELAND AND MASHONALAND.

This region, which is now under the government of the South African Company, extends from about 22° S. northwards to the Zambesi and the borders of Lake Nyassa. Its boundaries are as yet imperfectly defined. The country is diversified with undulating table-lands, grassy plains, and tracts of forest, rising in the Matoppo and Mashona ranges, which form the watershed between the Zambesi and Limpopo, to heights of 4000 and 5000 feet. At Inyati (19° 35′ S.), at an altitude of 4000 feet, the climate is pleasant, but the weather during the summer season is liable to sudden and extreme fluctuations. The rainy season lasts from November to March, during which the plains are converted into vast swamps.

The winter is healthy in all localities, and the elevated, better drained localities are free from fever at all seasons; yet it should be stated that the marshy tracts are by no means free from malaria. Fevers, sufficiently severe to induce cachexia, prevail during summer.

Diarrhœa and *Dysentery* are, however, the most troublesome diseases, both of natives and Europeans.

Rheumatic Affections are very common.

BECHUANALAND.

GEOGRAPHY AND CLIMATE.—It is unnecessary to define the political boundaries of Bechuanaland, as it is sufficient for our purpose to consider it as stretching from the Orange River in the south to the confines of Lake Ngami in the north, and from the Transvaal in the east to Namaqualand in the west. The general elevation of the country is from 4000 to 4500 feet. The eastern part of Bechuanaland, bordering on the Transvaal, consists of elevated plains, intersected by ranges of hills, forming beautiful and fertile valleys, which mostly drain into the Limpopo or into the Great Marico river, as the upper part of the Limpopo is called. The western part drains into the Molopo, a summer tributary of the Orange River. The eastern districts are well watered by numerous streams during the rainy season, and when these fail, water of excellent quality is obtained by digging in the beds of the rivers or by sinking wells. In some localities, such as Kuruman, perennial fountains exist, which are used for irrigation. Wherever water is to be had, European cereals can be profitably cultivated; but, as a whole, the country is much better adapted for the rearing of cattle than for agriculture.

The country to the west of 24° E. long. is known as the Kalahari desert. It is a level plain, the soil of which consists almost of pure silica, except in the beds of ancient rivers, where it is alluvial. Although there is no running water in the desert, and very little water in wells, and although the rainfall is scanty, yet the country is covered with tufty grass, a great variety of creeping plants, and large patches of bush. Large herds of antelopes range over this vast plain, which is very sparsely inhabited by nomadic tribes of Bushmen and Bakalahari, who live on game, and on the roots and plants which grow without cultivation.

The rainy, which is the summer, season lasts from November or December till April. The rainfall on the eastern table-land reaches on an average about 25 inches, but severe and prolonged droughts are not uncommon. During winter a shower seldom falls. The temperature is highest before the rain begins to fall, when it often stands at from 80° to 96° F. in the shade; but when the rains set in the temperature falls considerably. Even during the greatest heat, the weather is not oppressive nor debilitating. The evenings are cool and the nights pleasant. Livingstone says, "You wish for an increase neither of cold nor heat, and you may sit out of doors till midnight without thinking of colds or rheumatism." In the winter snow occasionally falls at Kuruman, but this is not common. The frosts, however, are sometimes keen, but the temperature in the sun, even during the winter, is high. The most marked character of the Bechuanaland climate is its dryness, which renders both the heat and cold not only bearable, but exhilarating.

The principal towns, or villages, are Kuruman, Vryburg, Mafeking, and Shoshong,—the latter a town of some 20,000 to 30,000 inhabitants.

PATHOLOGY.—*Malaria.*—Intermittent fever is scarcely known south of Shoshong, and even in this district it is rare, and confined to low-lying marshes and lagoons; the high-lying countries adjoining being free from the disease. The remittent form is extremely rare. Mackenzie remarks that "it is a mistake to suppose that Europeans are more subject to this disease than Africans. My experience goes to show that the natives, who hail from a healthy region, are perhaps more liable than Europeans to suffer from malarial fever. Men and women are equally subject to the disease." Mackenzie mentions the case of a European lady who travelled for months in a malarious district without an attack.[1] Her confinement took place after leaving the region, and she afterwards reached Kuruman. There, however, she was struck down with a very severe attack of malarial fever unknown in that district. Autumn and spring are the seasons when cases of fever are observed.

Typhoid Fever.—The occurrence of typhoid fever in the Bechuana Field Force has already been noticed in treating of fever in the Cape. It was supposed by Faught to be of malarial origin, but I think there can be no doubt that it was modified typhoid. It occurs during the late rains. Typhoid fever has been observed at Kuruman, having been introduced by people from the Transvaal, where it happened at that time to be raging. This disease, so far as is at present known, is rare among the Bechuanas.

Smallpox, called *Sekoripane*, a word having reference to the numerous eruptions, is not endemic. It has always been introduced, and after a short time it has disappeared. Vaccination is now compulsory.

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[1] I am indebted for much of the information respecting the diseases of Bechuanaland to the Rev. John Mackenzie, whose long residence in the country and intimate acquaintance with the common diseases of the natives gives it a value that seldom attaches to the observations of laymen. The Rev. Mr. Wookey has also kindly supplied a few particulars.

Measles has usually accompanied or followed smallpox. It is called *Sekoripane se senye*—the little pox. It does not appear to be a native of the country.

Scarlet Fever.—One or two cases have been met with in the course of many years. It is much milder than in Britain (Mackenzie).

Whooping-Cough is common, but is milder than in England.

Diphtheria was quite unknown in those parts of Bechuanaland with which Mackenzie was acquainted until quite recently, when it appeared at Kuruman; but, from the observations of Wookey, it has not by any means been limited to this locality. Hirsch says that diphtheria is common in the adjoining Orange River Free State.

Croup—fatal here as elsewhere—is of occasional occurrence in children, black and white.

Diarrhœa is about as frequent among children, native and European, as in Europe.

Dysentery is a dangerous disease in Bechuanaland, affecting both Europeans and natives, and usually occurring in early summer, before the rains have fallen.

Bronchitis and *Pneumonia* are rare. Bronchitis chiefly occurs in children. Catarrhs here are seldom serious. Livingstone observes that these and similar complaints become rare as the people adopt the European dress. This is not the result which has been observed to follow the adoption of European clothing by the aborigines of Australia (page 564).

Phthisis.—Livingstone states that there is no consumption or scrofula in Bechuanaland. This, so far as it concerns phthisis, agrees with Mackenzie's experience, who remarks that consumption may be said to be unknown in this region, and that the climate of Bechuanaland is capable of curing the disease in its earlier stages. "Cases have been known," says Livingstone, "in which persons come from the coast with complaints closely resembling, if they were not actually those of consumption, and they have recovered by the influence of the climate alone."

Liver Complaints are known, but do not prevail to any large extent.

Leprosy.—A few cases have been heard of both by Mackenzie and Wookey, but it is just possible that the cases they refer to were not cases of true leprosy. At any rate, the disease cannot be said to be endemic in the country.

Syphilis.—Livingstone was of opinion that syphilis was incapable of permanence in any form, in persons of pure African blood, anywhere in the centre of the country. This opinion was based on the fact that the disease was unknown amongst the Bechuanas in his time, and also that when it had been introduced from the west coast it had died out without the aid of medicine. At the present day, from the greatly-increased intercourse with Europeans, this disease is now common among the natives. Rupia appears to be a common manifestation of the constitutional taint.

Cancer is not absolutely unknown, but is extremely rare.

Rheumatism and *Heart Disease* are mentioned by Livingstone among the more prevalent diseases of the natives.

Ophthalmia is very prevalent and very severe throughout Bechuanaland, as indeed it is throughout the greater part of South Africa. It is met with in a serous and in a purulent form, and is propagated by contagion. Mackenzie makes the curious observation that it is most severe in marshy localities.

CHAPTER XI.

EAST AFRICA.—THE COAST REGION, THE SOUTH AND EAST CENTRAL REGIONS.

GEOGRAPHY.—The coast-line to the north of Panga-ni, opposite to the island of Pemba, is abrupt, terminating in cliffs from 40 to 60 feet high. To the south of this point the coast is low, being here skirted by a marshy belt of varying breadth, which narrows towards the north, and finally disappears at the point which we have mentioned.

Crossing this swampy plain in the latitude of Zanzibar, the land is found to rise by a gradual ascent for a distance of 70 or 80 miles, until we reach the coast plateau, which has an elevation of from 1500 to 2000 feet. This plateau, which has here a breadth of about 80 miles, disappears towards the north, where the country becomes more elevated.

During the rains, the coast plateau forms a continuous swamp, in which water is everywhere found near the surface. It is covered in the mornings by dense mists, which only disappear as the sun gathers strength. During the dry season it becomes converted into a parched plain, most of the streams disappearing, so that water can only be obtained by digging to a depth of 10 or 15 feet in their beds. The smell evolved from the swampy coast belt, and from this plateau, is described as sickening, especially after the first rains have fallen.

The coast plateau is bounded on the west by the eastern wall of that mountain range which, under various names, extends from Abyssinia to Cape Colony. Here, this mountain range supports a table-land which runs westwards to the shores of Lake Tanganyika, where it is bounded by the Ujiji and Kawendi Mountains, some of the peaks of which attain elevations of 7000 feet. To the north, it gradually encroaches upon, and finally replaces, the coast plateau of which we have been speaking.

This elevated region, although forming part of the great central plateau, presents, nevertheless, certain distinctive physical features, and, besides, being better known pathologically, may for the sake of convenience be distinguished from the districts lying to the west of the lakes as the Eastern Mountain Region. This part of the table-land, with an average elevation of 4000 feet, although bounded on the east and west by mountain chains, and intersected in some parts by minor ranges of hills covered with forest, presents extensive stretches of undulating prairie, and wide expanses of level swamp and jungle. The physical features of East Central Africa, so far as they interest the pathologist, may be gathered from Cameron's description of the region traversed by him, and which applies more or less to the country north and south of his route. Thus, "to the south-west of Unyanyembé rocky hills cease, and the broad alluvial plain is partly jungle and partly plantations." Ugara, again, is described as "a flat plain covered with forest and jungle." Undulating grassy plains and level jungly swamps characterise the country stretching between Ugara and Lake Tanganyika, which drains into the Malagarazi river, some of the affluents of which spread for three or four miles over the surrounding country during the rainy season. The more elevated, undulating, better drained, and partially cultivated localities present conditions moderately favourable to European settlement; but it will only be when the country is cleared and cultivated that the region, as a whole, can be expected to be free from endemic diseases.

Crossing the Tanganyika, we traverse the hilly country lying between the lakes and the valley of the Lualaba, to the west of which, and all along the Lomâmi, the country is level, with deep gulches worn out by the innumerable streams, and is in many parts swampy. This country is bounded on the west by the Kilmachio ranges, beyond which broad and well-watered plains extend as far as Kilemba. West of Kilemba the country consists of "wooded hills, flat table-lands of sand, and broad marshes bordering the streams," continued through Ussambi as flat-topped sandstone hills. The Ulunda country is thickly wooded, with gentle undulations and occasional savannahs or meadows, watered with innumerable streams, merging in the west into the broad plains that stretch right across Lovalé. This forms the watershed between the Congo and Zambesi basins, and, in the rainy season, these plains are waist-deep in water—the two basins thus actually join. West of Lovalé is the country of Kibokwé, which is in great part covered with forests. This is one of the highest parts of the southern plateau; Lake Dilolo, to the east of Kibokwé, lies at an altitude of 4700 feet. It is only when we cross the valley of the Zambesi, or Leeba, and ascend the western mountain range, that higher altitudes, such as 5800 feet, are attained.

North of the Victoria Nyanza, the country traversed by the Upper Nile slopes towards the Mediterranean. The level of the Victoria Nyanza is about 4000 feet, while that of Khartum is 1200 feet. The physical features of this region have already been noticed in the introductory chapter.

The regions which form the subject of this chapter, comprising nearly one-third of the entire continent, consist—(1) of the coast districts, extending from the Indian Ocean to the eastern boundary of the great mountain range, including not only the low marshy coast belt, but also the coast plateau and the intervening country; (2) the mountain region east of the lakes; (3) that part of the central plateau known as the lake region, and the high lands stretching between the Congo and the Zambesi; (4) the Egyptian Soudan, traversed by the Nile and its tributaries, such as the Bahr el-Ghazal, the Bahr-el-Arab, the Sobat, the Bahr-el-Azrek or Blue Nile, and the Atbara.

CLIMATOLOGY.—The climate of the east coast is hot and, during the rains, excessively humid. The shade temperature at Mombasa, according to New, ranges between 20°·5 and 32°·2 C. (69°–90° F.). It is drier and less relaxing than that of Zanzibar. Yet it is sufficiently trying, and this even more so from the uniformity than from the excess of the temperature. During the dry season at Mombasa (November to April), "trees lose their leaves, the grasses perish, the earth cracks, the air becomes exceedingly dry, the sun blazes furiously, and a deadly haze overhangs all" (New).[1] At Zanzibar the mean annual temperature is 26°·7 C.; the coldest month is July (25°·2), and the warmest is February (28°·1). At Teté, in lat. 16° 10′ S., the annual mean is 26°·7; that of July, the coldest month, 22°·5; and that of November, which is the warmest month, 28°·7 C.

The following table gives, in millimètres, the monthly rainfall of three stations, from north to south, according to Hann:—

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[1] New, *Life and Wanderings in East Africa*, London 1874.

Months.	Mombasa (4° S. lat.).	Zanzibar (6° S. lat.).	Teté (16° S. lat.).
January,	40	100	198
February,	42	125	98
March,	86	250	198
April,	198	600	32
May,	312	425	13
June,	124	100	13
July,	132	75	0
August,	92	75	0
September,	77	75	0
October,	124	150	0
November,	143	225	115
December,	48	300	186
	1418	2500	853

There are two rainy seasons along the East Coast, the lesser coincides with the months of October and November at Mombasa; lasts from October to December at Zanzibar, and from November to January at Teté. The greater rainy season extends from April to July at Mombasa; from March to June at Zanzibar; while at Teté the corresponding period seems limited to the month of March only; but further observations are required for this station. In the rainy season—January and February principally—"the Zambesi overflows its banks, making the country for an immense distance one great lake, with only a few small eminences above the water" (Parker).

At Blantyre (3000 feet), situated in the southern part of the mountainous table-land east of the lakes, the temperature of the year is given at 18°·2 (64°·8 F.). The warmest months are October and November, 23°·5 and 23°·3 respectively; the coldest months are June and July, with temperatures of 15°·0 and 14°·5 respectively. At Bandawe, on Lake Nyassa (1522 feet), the temperature is not only higher, but, if we may trust the accounts we have of it, the seasons differ considerably from those at Blantyre. The thermometer often reaches 85° F. (29°·4) at mid-day in November, which is said to be the warmest month of the year; while the average night temperature of the coldest month (May) is about 60° F. (15°·5). To the north the temperature of the mountain range will, of course, be higher, but it has not been found to be oppressive at elevations of 4000 feet, even during the warmest months.[1] Referring to the climate of the Nyassa-Tanganyika

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[1] At Mpwapwa, Pruen found the temperature to be as follows:—

	Day Maximum.	Night Minimum.
Hot Season,	80°–90° F.	65°–70° F.
Cold Season,	70°–80° F.	60° F.

plateau, Drummond remarks that the nights in Equatorial Africa are really cold, and one seldom lies down in his tent with less than a couple of blankets and a warm quilt. The heat of New York is often, he says, greater than that of Central Africa; the highest temperature registered by him in this district being 96° F. (November).[1]

The rainy and dry seasons on the Eastern Mountain Region correspond with those on the coast, but the lesser and greater rains occur about six weeks later, the period being retarded in proportion as the distance from the coast increases. The annual amount of rainfall at Blantyre is about 1416 mm., and at Nyassa 2300 mm.

The data relating to the plateau west of the lakes are very scanty, consisting only of unconnected observations, which barely suffice to give a general idea of the character of the climate in this region. West of Lake Kassali, Cameron observed the thermometer in November to stand at 100° F. in the shade. A little to the south of this, but still in the same region, the heat during the day is stated to have been excessive, while in the morning the temperature fell to 46°·5 F. The daily range in this region must thus at certain seasons be high. In the Lovalé country, near to Kafundango, Cameron observed the minimum thermometer to mark 38° F.; and in descending into the dip through which the River Luvua drains into the Zambesi, he found the pools covered with ice.

In the neighbourhood of Lake Dilolo (lat. 11°–12° S.) winter extends from the middle of February to the end of August. The following observations of temperature were made by Livingstone in this locality, which has an altitude of about 4500 feet:—

	Morning.	Mid-day.	Evening.
January 23rd, . . .	82°	...	82°
February 19th, . . .	...	90°	...
June 14th (mid-winter), . .	50°	80°–90°	76°–80°

Although the mid-winter temperature is high during the day, the mornings are very cold, from the air being loaded with moisture. The extreme daily range is 40° F. In the Barotse valley, during the prevalence of the south wind, the thermometer sinks as low as 42°, and conveys the impression of bitter cold.

At Linyanti (18° 17′ S.), situated between the Chobe and Zambesi, at the altitude of 2813 feet, cold east winds prevail in May. "There is frost even as far north as the Chobe, and a partial winter in the Barotse valley." Yet the heat of the mid-day sun, even during winter, is here very great. In October (which corresponds to spring), Livingstone found the day temperature in the shade to reach 100°; at sunset to stand at 89°, and at sunrise to sink to 70° F.

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[1] Drummond, *Tropical Africa*, London 1889.

On the elevated country (probably about 4000 feet above the sea-level) south-east of the Victoria Falls, Livingstone found the temperature in November, after the rains had begun, to be 70° at 6 a.m., 90° at mid-day, and 84° in the evening. This district is on the high lands of the Matebele country, now under the British Protectorate.

The rainfall at Bangweolo is estimated at 1170 mm., and in the Bambarre country, between the Tanganyika and the Lualaba, at 1470 mm. No estimate of the amount has been made for any other district west of the lakes, but from what we have stated above, of the Lovalé country standing waist-deep in water during the rainy season, we infer that the rains are heavier there than in the east. The rainy season, to the west of the lakes, extends from October or November to April or May. In the Barotse valley, and south to Lake Ngami, the early rains fall in October and November; the months of December and January, which are dry, are followed by the greater rains in February, March, and April. It is during the latter part of the greater rains that the annual inundation of the Liambye, or Upper Zambesi, occurs, leaving behind it pools which in some cases are not dried up before the succeeding rains set in. In the middle course of the river three or four floods occur annually, but the periodical inundation, so marked in the Liambye, is not recognised.

The following table, constructed from Hann's figures, gives the mean temperature of the year, and that of the coldest and warmest months, and the rainy season, at three stations, from the Victoria Nyanza northwards:—

Station.	Latitude.	Altitude in Mètres.	Temperature of the Year. C.	Temperature of Coldest Month. C.	Temperature of Warmest Month. C.	Rainy Season.	Annual Rainfall. mm.
Rubaga, .	0° 30′ N.	1300	21°·4	August (20°·0)	March (22°·1)	All the year.	1270
Lado, . .	5° 2′ N.	465	26°·7	July & Aug. (24°·8)	Feb. & Mar. (29°·6)	April–Sept.	...
Khartum,	15° 36′ N.	388	28°·6	Jan. (22°·7)	June (34°·5)	July–Sept.	Scanty.

The mean annual temperature throughout the whole of this region is high, and near the equator the difference between the temperature of the warmest and coldest months is slight. The diurnal range is here also comparatively limited, the nights being often oppressive. This does not apply to the higher lands of the west, which form the watershed between the Nile and the Congo, the climate of which is said by Casati to be mild and salubrious.

At Khartum, in the north, the difference between the coldest and warmest months reaches 12° C. The summer temperature is excessively high. Very great and sudden fluctuations are here observed to occur, under the influence of storms and of certain winds.

PATHOLOGY OF THE EAST COAST REGION.

Malaria.—Malarious diseases prevail with great severity not only along the coast, but inland in the swampy tracts, to elevations of 2000 feet. The country along the Maputa, where it flows into the southern part of Delagoa Bay, ranks, according to O'Neill, amongst "the most pestilential districts of Africa."[1] Fever is also very prevalent and severe at Laurenço Marques, in lat. 25° 53′ S. Strangers residing for a short time in this town during the unhealthy season, which here begins in October and November, are sure to be laid up with fever.[2] Another very unhealthy district is met with near the mouth of the Limpopo river, which falls into the northern part of Delagoa Bay. The natives who inhabit the Quanyambe marshes in this locality are physically and morally deteriorated by the malarious conditions under which they live.

The whole extent of the Sofala coast is subject to fever, but some localities are less unhealthy than others. Inhambane (23° 51′ S.) enjoys a comparative immunity, while Sofala, on the other hand, is described by Roquete as "un des points les plus insalubres de la côte Mozambique." The small streams near the town, finding no ready discharge, stagnate and form marshes covered with mangroves, and to this the extreme unhealthiness of the town is ascribed.

When we come to the Zambesi we find malaria to be still the predominating disease. Livingstone's account of the village of Kilimane, situated on the northern mouth of the Zambesi, illustrates so well the physical features associated with malaria, not only in this special locality, but generally along the Mozambique and the southern part of the Zanzibar coasts, and his description of the effects of the malarial infection acting as a slow poison, is so graphic, that I shall give them in his own words.

"Kilimane," he says, "stands on a great mud-bank, and is surrounded by extensive swamps and rice grounds. The banks of the river are lined with mangrove bushes, the roots of which, and the slimy banks on which they grow, are alternately exposed to the tide and sun. If one digs down two or three feet in any part of the site of the village he comes to water."[3] He adds: "It is almost needless to say that Kilimane is very unhealthy."

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[1] *Proceedings, R.G.S.*, 1885.

[2] Baines, *Gold Regions of South-East Africa*, London 1877. See also Pinto Roquete, *Archiv. de méd. nav.* t. ix.

[3] Livingstone, *Missionary Travels and Researches*, London 1857.

Livingstone narrates the fate of the crew of a Hamburg vessel which was lost near the bar, which vividly exhibits the effects of the climate of the East Coast on Europeans. "The men were much more regular in their habits than English sailors, so that I had the opportunity of observing the fever acting as a slow poison. They felt 'out of sorts' only; but gradually became pale, bloodless, and emaciated, then weaker and weaker, till at last they sank, more like oxen bitten by the tsetse than any disease I ever saw." The disease does not always, however, follow this slow course. Mrs. Livingstone, for instance, died within a week from the onset of the fever. In her case the fever was attended with constant vomiting, succeeded by delirium and coma.

The coast-line from the Zambesi north to Panga-ni, and inland to the eastern boundary of the mountain range, is all to a high degree malarious. The banks of the larger rivers, such as the Shiré, the Rovuma, the Rufigi, and the Wami, have been proved to be extremely unhealthy, by the manifold experience of explorers, travellers, and missionaries. Roquete, referring to the Mozambique coast, says that "malarial fever dominates over all the other endemic diseases, and absorbs, so to speak, the pathology of this region. It exists not only as a distinct morbid entity, but complicates all other maladies. The malarial cachexia is the inevitable result of a prolonged sojourn on the coast." Among the localities which experience has shown to be to a marked extent malarious, we may mention Bagamoyo. Perhaps it is really not worse than many other parts of the coast; but, as the starting-point for travellers into the interior, the town and its neighbourhood is comparatively well known. Dutrieux has described it as "a veritable graveyard for Europeans."[1] The men belonging to the vessels of the German Navy stationed at this place, get so severely affected with malaria, that they have to be transferred in large numbers to Zanzibar for treatment.[2] Inland from this town is the Makata swamp, so much, and with such good reason, dreaded by travellers.

To the north of Panga-ni the country is more elevated and less unhealthy. Mombasa, the chief port of the British Protectorate, is certainly more salubrious than the towns and villages to the south; but neither the town itself, nor the surrounding country near, can be regarded as healthy. New, referring to the country near to Mombasa, says that "no man can live long in the jungle of East Africa without being attacked with the *Mkunguru*, the fever of the country." The uniformity of the temperature, and the constant recurrence of fever, according to this observer, "surely undermines the constitution of the European, who loses his strength, and falls into a state of lassitude and emaciation. If the country could be brought under cultivation, it would be improved; but the sameness of the temperature must ever militate against the health of Europeans." At the higher elevations of the interior, where the temperature is not only lower, but less uniform, the conditions are of course more favourable than on the coast, to which alone these observations apply.

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[1] Dutrieux, *Maladies des Européens dans les pays chauds*, Paris 1886.

[2] Drago, *Archiv. de méd. nav.* 1890.

The fever of the southern part of this coast, as it affects the Europeans, is of the remittent or bilious-remittent form. Pernicious attacks also occur, although, according to Roquete, not primarily, nor before the third accession of the fever. We have already described the slow action of malaria on the system without the phenomena of fever. The fever met with around Mombasa, and for some distance inland, is described as a severe intermittent, returning at intervals of two, three, or four days, according to the type it may assume. It sometimes merges into the remittent form, which may also (although less frequently) be the primary manifestation. Closer observation will perhaps show that the intermittent is generally preceded by a period of sub-febrile *malaise* of a continued form.

Typhoid Fever has scarcely been observed on this coast. Roquete, indeed, reports its occurrence on the Mozambique coast, but he states that it is rare, mild, and of a modified type. The disease is one so little likely to be recognised by the ordinary traveller, and one which may so readily escape the observation even of the medical man who is merely passing through the country, that we are not warranted in inferring its absence, or even its extreme rarity, from the fact that it has not been noticed by those who have written about the diseases of this region. The most that can be said is that, in its ordinary form, it is not of frequent occurrence on the East Coast.

Diphtheria is stated by Roquete to have appeared for the first time at Laurenço Marques in 1837, having, it is thought, been imported from Natal. It has since become endemic over a considerable part of the Sofala coast, but its area of diffusion, and its degree of prevalence at the present day, cannot be accurately defined. This disease, which is known on the Sofala coast as *Matuniça* or *Mapute,* is characterised at the period of invasion by the appearance of numerous pustules on the tongue.

Cholera made its first appearance on the Zanzibar coast in 1820, having no doubt been introduced from the north. In 1837, Zanzibar was attacked for the second time, the disease having, as before, made its way down the coast from Somaliland. On this occasion the epidemy was almost entirely confined to the negro population. In 1858–59, the East Coast was again invaded by the same route as on the previous occasions, and although the negroes were once more the principal sufferers, it was observed that the Arabs did not enjoy quite the same immunity as in 1837; but the Indians and Europeans escaped almost unscathed. The epidemy of 1869–70 was a very fatal one. It was imported into Zanzibar "from the territory of the Wamassi, a nomadic pastoral people, who appear to have got it from Central Abyssinia, by way of the Gallas country"[1] (Hirsch). It spread along the coast from Brava, in 1° N., to Cape Delgado, in 11° S. lat., which is the most southerly point to which cholera has hitherto extended on this coast. It is difficult to say how far inland it reached. In a footnote in Livingstone's *Last Journals* we read: "Dr. Kirk says it (cholera) again entered Africa from Zanzibar, and followed the course of the caravans to Ujiji and Manyuema."[2] This statement, derived no doubt from the reports of native caravan leaders or followers, is not to be depended on. Pruen could not find any history of an invasion of cholera in the region east of the lakes, and twenty years is scarcely sufficient to obliterate the memory of such an event from the mind of the natives. Altogether, it seems most probable that, as an epidemic disease, it was confined to the coast and adjacent islands; although it does not follow that sporadic, or even slight localised outbreaks, may not have occurred at certain points on the table-land.

Dysentery and *Diarrhœa*, next to malarial fever, are the most common diseases of the East Coast, and are probably the most fatal of the diseases to which the native is subject. Dysentery seems to be most prevalent from February to May, and, again, during the months of September and October, when it sometimes becomes epidemic. According to Pruen's observations, the natives set all physiological rules at defiance in regard to the alimentation of their infants; and although the results do not appear to be so disastrous as might have been anticipated, this neglect of natural laws no doubt tends largely to increase the diarrhœal mortality of infants and young children. The bad quality of the drinking water is one of the principal causes of the prevalence of dysentery on the East Coast, especially among Europeans. The native may be supposed to be to some extent habituated to its use, and consequently to be less liable to be injuriously affected by it; but the Europeans who would escape the disease, had better eschew entirely the use of unboiled water in tropical Africa. The diurnal range of temperature has been accused of contributing to the development of dysentery on the Zanzibar coast.[1] No doubt the rapid abstraction of heat from the body by the clothing being drenched with rain, or by exposure to the chilling influence of night air, is an etiological factor of some importance in the development of dysentery here as elsewhere, but the diurnal range of temperature cannot count for much in relation to the prevalence of dysentery in this region; for, as a matter of fact, few parts of the world have a more equable temperature than the Zanzibar coast. The mean daily range at Zanzibar varies from 2° F. in May and November to 5°·4 F. in February.

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[1] Others hold that the disease reached Zanzibar on this occasion by the caravan route from the interior through the Masai country.

[2] Livingstone's *Last Journals*, London 1874, p. 96.

Dysentery is frequently met with as a complication of fever in this region.

Smallpox is a disease of such frequent occurrence on the Zanzibar and Mozambique coasts, that it has been generally regarded as endemic in this region, and this view is probably correct. The etymology of the Malagasy word for smallpox points to its introduction into that island from the Mombasa or Somali coast, probably at a remote period. Its outbreaks in the lake region have been attributed to its introduction from the coast by means of the caravans passing between the coast and the interior. It is just as likely, however, that the disease is as frequently carried from the interior to the coast, a view which receives a certain degree of support from the fact that the coast districts near to the caravan routes are those that suffer most, and that the disease becomes less prevalent as we proceed south towards the Sofala coast. The caravans, whether to or from the interior, are seldom without cases of smallpox, so that we may readily believe that the disease is largely diffused in both directions by the agency of the caravan traffic, the sanitary regulation of which would do much to limit the prevalence of the disease in East Africa.

Measles.—Although I have met with no accounts of the occurrence of this disease on the mainland, yet the fact that epidemics of measles are by no means rare in Zanzibar and Madagascar, renders it exceedingly probable that the disease is not unknown in the coast country.

Scarlet Fever is apparently not met with on the East Coast; whether *Whooping-Cough* is known, cannot be determined from the imperfect data at our disposal.

Phthisis, so far as we can judge, is not a common disease amongst the natives.

Bronchitis occupies a subordinate place in the pathology of this region. *Pneumonia* and *Pleurisy* are of more frequent occurrence, and, according to Roquete, they attack by preference the Asiatics and the Europeans who have resided for some time in the country. Both diseases are most common at the beginning of the rainy season.

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[1] Semanne, quoted by Hirsch.

Hepatitis is by no means uncommon among the Europeans on the coast, although its frequency has perhaps been somewhat exaggerated. We have no means of judging to what extent the natives suffer from inflammation of the liver. Referring to the Mozambique coast, Roquete says that abscess of the liver is rather rare.

Syphilis is widely prevalent all along the coast, becoming less so as we advance inland. The disease known by the natives as *Bubas* is identified by some with yaws. I think that it is rather a form of syphilis, similar to the *tety* of Madagascar.

Elephantiasis is exceedingly common, both on the Mozambique and Zanzibar coasts. *Ulcers* of a very severe and intractable character are endemic throughout this region, from Somaliland on the north to Delagoa Bay in the south. The form of ulcer known as the "Mozambique sore" is thus described by Lombard: "It commences by a small bleb filled with yellow serosity, which is succeeded by a circular ulcer, which enlarges day by day, deepening progressively from the circumference to the centre, where it forms a kind of funnel. Its surface is always covered with fungosities, and bleeds readily. It is chiefly met with on the legs, feet, and hands. When the feet and hands are affected, it is not uncommon to see the phalanges drop off."

Leprosy is endemic on the East Coast, but no estimate of the proportion which lepers bear to the population is possible. A village is now in progress of construction, about two miles inland from Bagamoyo, for the isolation and treatment of this class of sufferers, who are stated to be somewhat numerous in this locality.

Goitre is occasionally met with in localities where the soil is a fossiliferous limestone (Pruen).

PATHOLOGY OF SOUTH CENTRAL AND EAST CENTRAL AFRICA.

Malaria.—Following the Zambesi inland, we come to the neglected village of Sena, above the delta, with its surrounding bush and stagnant pools. Fever is severely endemic in this locality; for Livingstone tells us that 25 out of 104 soldiers from Portugal, stationed here, were cut off by fever within a year. The post of Teté, still higher up the river, situated in 16° 9′ S. lat., is placed on a slope leading down to the river, and in a comparatively well-cultivated district. It is much less unhealthy than Sena,—the fevers met with here being of a mild type, and lasting for about three days. The difference in salubrity between these two stations cannot be ascribed to climate or altitude; for in neither of these respects does Teté differ much from Sena. The local conditions to which we have alluded account for the extreme unhealthiness of the one, and the comparative healthiness of the other. When the specific cause of fever is present in the soil of any region, as it everywhere is in that of East Africa, the character of the soil, especially as regards stagnant humidity, becomes an important factor in the development of the infection, which is still further favoured by a high temperature.

The middle course of the Zambesi, from the Victoria Falls eastward to Teté, is through a comparatively elevated country. The Victoria Falls are 2580 feet above the sea-level; that of Teté 400 feet. But the river is liable to overflow its banks, and numerous streams from the high lands to the north and south form marshes near their entrance into the river. The country bordering the river is thus all more or less malarious, and the fever is more severe in the lower stretches, where the elevation is less and the temperature comparatively high. To the west, where the elevation is more considerable, the fever is of a milder type, but it is, nevertheless, capable of inducing cachexia in Europeans. To the south of the river, the country rises gradually towards the Matoppo and Mashona ranges, which have an elevation of 4500 feet, and form the watershed between the Zambesi and Limpopo basins. In proportion as the country rises, fever becomes less frequent, and the northern slopes of the Mashona range may be considered to be free from malaria.

To the west of long. 27° E., the country south of the Zambesi falls rapidly from an average elevation of 3600 to one of 2813 feet —the level both of Lake Makarakara and of Lake Ngami. It is into these two lakes, especially into the latter, that the whole country lying between 18° 30′ and 22° S., and between 20° and 26° 30′ E., drains. This region corresponds to what is sometimes spoken of as Eastern and Western Bamangwato. The country is largely dotted over with salt or brackish lakes. The principal streams running into Lake Ngami from the north are the Tonka and Malabe rivers, which are connected by cross branches. Another network of streams, traversing a country much of which is swamp and bush, connects the Tonka with the Cubango, and the Malabe with the Chobe, and both with the Zambesi. To the south of the Ngami, the country is drier and free from marsh. In this western region, which, as we have seen, has a much lower elevation than Mashonaland and Matabeleland, the dry districts of the south are free from malaria, while the shores of Lake Ngami and the country lying between that lake and the Zambesi, especially the marshy banks of rivers, such as the Chobe and the swampy intervening tracts, such as those met with in the country lying between that river and the Cubango, are highly malarious.[1] It was at Linyanti on the Chobe river, about 2900 feet above the sea-level, that Livingstone experienced his first attack of fever. "Cold winds," he says, "prevailed at this time (May 30th), and as they came over the extensive flats inundated by the Chobe, as well as other districts, where pools of water are now drying up, they may be supposed to be loaded with malaria and watery vapour, and many cases of fever follow." The majority of the Makololo tribe which emigrated to this region from the healthy districts bordering the Kalahari, were cut off by fever. The women, it is remarked, generally escaped the fever, but became less fruitful than they were in their native land. The indigenous inhabitants, although they are not exempt from fever, suffer in a less degree than strangers. The fever from which Livingstone suffered was of the tertian type; and the intermittent, accompanied with enlargement of the spleen, is, he says, the form usually observed south of 8° S. lat. The Sesheke country north of the Zambesi,[2] and the rich, well-wooded, and level Barotse valley, subject to annual overflow, are no better, as regards fever, than the Chobe region. Livingstone says that "the Makololo have an aversion to this valley on account of the fevers that are annually engendered as the waters dry up;" but fever, we are told, is the only disease prevalent in the valley.

As we advance to the north along the valley of the Leeba, fever, varying in intensity according to the topographical features of the locality, is everywhere the prevailing disease. At Cassanje (lat. 9° 37′ S.), situated in a deep valley, although at a very considerable elevation above the sea-level, "with nothing, perhaps, except the rich luxuriance of the vegetation to indicate unhealthiness," Livingstone found nearly all the Portuguese inhabitants to be "suffering from enlargement of the spleen, the effect of frequent attacks of intermittent fever, and to present a sickly appearance. Many of the children are cut off by fever." Of the country west of the Leeba, and forming the watershed between the Congo and Zambesi, so little is known, that we can only infer, from the almost complete absence of reference to fever in the writings of those who have visited the country, that malaria is of rare occurrence or of a mild type in this region.

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[1] Anderson, *Proceedings, Royal Geo. Soc.* 1884.

[2] Holub, *Seven Years in South Africa*, London 1881.

The case is different when we approach the lakes, where we find malaria to prevail along the shores of Lake Bangweolo in the south, and on the banks of the Lomâmi and Lualaba, and in the Manyuema country in the north, and, so far as we can judge, in all the plains between these districts and the great lakes, varying in intensity, however, according as marshy conditions are more or less prevalent. Thus, Cameron remarks, that while the right bank of the Lualaba is raised and healthy, the left bank is low and swampy, with many semi-stagnant back-waters, which render it a very hot-bed of fever.

Along the shores of the great lakes, malaria, if not more widely diffused, assumes, at least, a graver type. At Livingstonia, on the shores of Lake Nyassa, built on a little bay encircled by magnificent mountains of granite, green to the summit with forest, the Scotch mission suffered such severe losses that it had to be abandoned, and the remnant of the missionaries have had to begin their task afresh 150 miles north on the same lake coast.[1] A part of this loss of life might have been avoided, had a better knowledge of the conditions determining the prevalence of malaria in such a country been possessed by those responsible for the selection of the first site; but the danger is to a certain degree inherent in the soil and climate of this region, and cannot at present be avoided. The shores of Lake Tanganyika are more or less malarious throughout, and in some places extremely so.

I have before me a list of thirty-three missionaries sent out to various places on the lake between the years 1876 and 1888, which has been kindly furnished to me by the Rev. Mr. Cousins. Of these, eight, or nearly one-fourth, died in Africa, mostly of fever and dysentery, and five were permanently invalided as a result of the climate. The death and disease rates of this party convey no favourable impression of the climate of this region. Fever of a milder type prevails on the shores of the Victoria Nyanza.

The higher lands to the east of the lakes are comparatively free from fever. Pruen, referring to this region, says that malarial fever, except in its milder forms, finds its limit at an elevation of 4000 feet, but even the severe forms may occur at this elevation in hollows among the hills.[2] The higher lands of the British territory to the north are also, he believes, free from fever except in isolated spots such as those we have indicated. This opinion is borne out by the report of the medical officer who accompanied the expedition sent by the East African Company from Mombasa to Lake Victoria. "The lands traversed are at an elevation of 3000 to 9000 feet above the sea-level. The climate is excellent, and fever almost unknown. The whole party enjoyed excellent health during the two years of their wanderings."[1] The comparative cold of the higher regions will, as Pruen remarks, bring out any fever latent in the system which may have been contracted elsewhere. Perhaps it may be in this way that we are to account for the severe attacks from which travellers have frequently suffered after they have for some time left the coast region for the eastern mountain range. Dillon, who accompanied Cameron, and who shortly afterwards perished by his own hand, during the mental disorder brought on by fever, and the depression and suffering caused by dysentery, gives a lively description of the fever which seized the party at Unyanyembé. It commenced with severe rigors,—"shaking enough to bring down an ordinary house." The disease lasted for four or five days, was attended with loss of appetite, giddiness, great prostration, and delirium. Cameron described his sensations to Dillon thus:—"The fellows have regularly blocked me in. I have no room to stir; the worst of it is, that one of the legs of the grand piano is on my head, and the people are strumming away all day. It's all drawing-room furniture that they have blocked me in with." On other occasions he felt as if he were several persons, each of whom were suffering the same torments. These forms of delirium are very common in African fever. Pruen ascribes much of the severer forms of malarial fever met with in this region to the use of unboiled drinking water derived from swampy ground.

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[1] Drummond, *Op. cit.*

[2] Pruen, *The Arab and the African*, London 1891.

Uganda, situated to the north of the Victoria Nyanza, lies at an elevation of from 4000 to 5000 feet. The climate is remarkably mild and equable, but "there is a good deal of ague, especially in the swampy districts near the capital."[2] The Mombutta country, to the north-west of the Albert Nyanza, is healthy in the better drained and higher lands in the west, but along the borders of the rivers, fevers of a somewhat severe type are observed. Casati states that the route from Tangasi to Lado, "owing to the numerous streams and the marshes they form, is extremely malarious; and this holds especially of the tributaries of the Dongu."[3] The country to the west of Mombutta is, however, remarkably healthy. "No miasmatic effluvia or excessive heat affects human existence. In this happy climate children do not require excessive care."[1] Malaria is much more generally diffused and of a more severe form in the countries traversed by the Upper Nile and its tributaries. It is severely endemic at Mrooli, Foweira, Fatiko, Dufli, and above all at Gondokoro, where the Catholic mission lost twenty-six of its agents in the course of a year. The swampy districts of the Bahr-el-Ghazal and the Bahr-el-Arab are very unhealthy, especially during the rainy season (April–September), the country bordering on the rivers and streams being that which is most affected. Schweinfurth states that " half the travellers that have ventured into these swamps have succumbed to fever, but that the natives do not suffer to anything like the same extent."[2] The banks of the Sobat and of the smaller streams which join the Nile from the east, as well as the Bahr-el-Azrek or Blue Nile, and the Senaar country generally, are notably malarious. The districts most severely and constantly affected are those where the ground is humid. The fever season throughout the whole of this region coincides with the rainy season, and those localities which in the dry season are comparatively or entirely healthy, become feverish when the ground becomes charged with humidity. Khartum, situated at the junction of the Blue and White Niles, in an arid district with a scanty rainfall and a high temperature, and where cultivation can only be carried on by means of irrigation, has no immunity from malaria, which is here, nevertheless, of a milder type than that observed in the swampy districts of the south.

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[1] *Proceedings, Royal Col. Inst.* vol. xxii.

[2] Wilson and Felkin, *Uganda and the Egyptian Soudan*, London 1882.

[3] *Scottish Geo. Soc. Magazine*, vol. iii.

Still farther north, in the country lying between the Setite and Salaam tributaries of the Atbara, fevers, chiefly intermittent in type, become prevalent as the rains begin to subside, but almost disappear during the dry season.[3] Similarly, in the neighbourhood of Kassala, the country, at other times bare, becomes covered with grass and jungle during the rainy season, and with the appearance of the rains (not when they are drying up) intermittent and remittent fevers begin to show themselves.

Kordofan is an elevated plain, sloping towards the north, with a maximum elevation of 2000 feet. It is entirely destitute of rivers, streams, or lakes. Although the country is superficially dry, water is found in many places near to the surface, and it is in such localities that the population is mainly aggregated, and it is in these also that malaria is most prevalent and intense.

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[1] Casati, *Ten Years in Equatoria*, London.

[2] Schweinfurth, *Travels*, vol. i. p. 138 ; Lupton Bey, *Proceed. R.G.S.*, 1887.

[3] Baker, *Nile Tributaries of Abyssinia*, London 1867.

Dar Fûr, situated to the west of Kordofan, is traversed from north to south by the rugged granite range of the Marrah, which sends many streams on the west to Lake Tchad; those on the east lose themselves in the sandy plain. The region extending between the Marrah range and Kordofan differs little from the latter; but the valleys of the Marrah hills are well watered and extremely fertile.

The dry season both in Kordofan and Dar Fûr lasts from October or November till May, and during the latter part of the season the weather is excessively hot. The plains become parched, and vegetation is almost entirely burned up. With the commencement of the rains, the face of nature is changed as if by magic. The naturally rich soil is speedily covered with vegetation, and in the more favoured districts large crops of millet are grown.

In Kordofan and Dar Fûr the dry season is healthy. Fever is rarely seen; but with the advent of the rains, malaria is developed and becomes widely prevalent throughout the whole extent of both countries, although in its more intense forms it is limited to the marshy districts.

Imperfect as this survey of the distribution of malarious diseases necessarily is, it nevertheless throws a certain amount of light on the conditions that determine their prevalence both as regards locality and season.

The incidence of malaria in this region is seen to be largely determined by soil and temperature.

As regards soil, several factors have to be considered, viz.—1. Its nature or composition, and its physical properties. 2. Its character as modified by the configuration of the country. 3. Its condition as respects humidity. 4. The influence of cultivation, and the manner in which this influence operates.

The nature of the soil appears to be of only secondary importance in relation to the prevalence of malaria. Light sandy soils, such as are met with in many parts of North Central Africa; alluvial deposits, which form the deltas of the larger rivers; the soft calcareous tufa met with in the basins of the Chobe, Zambesi, and other districts; the ferruginous conglomerate of the Lunda valley, and the dark tenacious loams of the Chobe flats, are each capable of developing the malarious infection. Malaria, in Africa, is not fastidious as to the character of the soil on which it grows. Wherever, in fact, vegetation can be supported, there the specific cause of malaria, whatever it may be, can be evolved, and it can even thrive in some localities where vegetation is scanty. It would be going too far to say that the nature or composition of the soil has no influence on the prevalence of malarial diseases, but other conditions are so much more important in this respect, that it is difficult to say what particular class of soils is most favourable to its development.

The physical characters of the soil and subsoil, especially as regards its porosity or impermeability, and as respects its power of absorbing and retaining moisture, are of great importance in determining the salubrity of a locality, as will be seen when we come to consider the influence of humidity in relation to the prevalence of fever.

The external configuration of a country or locality, and its underground or sub-surface configuration, exert an undoubted influence on the distribution and intensity of malaria.

The external configuration becomes of importance as it affects the humidity, temperature, and aeration of the soil of a locality.

The dead level of the coast plains, and of many of the central districts, when flooded either by heavy rains or by the overflow of rivers, presents a physical obstacle to the rapid discharge of the excess of moisture. The water, being unable to run off, either sinks into the soil, to a greater or lesser depth, according to the nature of the subsoil, or, if the surface-soil is an impermeable clay, it collects in pools, from which it slowly disappears by evaporation, and all the more slowly that the water is protected by jungle from sun and air, in either case producing a moist condition of the soil which experience proves to be highly favourable to the development of malaria.

Mountain valleys, again, with an insufficient fall, such as are met with on the table-land east of the lakes, are, as we have seen, often the seat of malaria of a severe type when the surrounding open country is comparatively free from fever. This is mainly owing to the fact that the bottoms of these valleys become surcharged with moisture. When the valley is narrow and bounded by rocky walls, which reflect the heat of the tropical sun, the day temperature is often excessive, and all the more so that the surrounding mountains exclude the free play of the winds. In such circumstances, the evils due to water-logging are augmented by the increase of temperature and the insufficient movement of the air. The prevalence of fever in the vicinity of rocks is not unknown to the natives. Wilson says, "I find that the Arabs had a curious idea that the rocks, of which there are many round Tabora, produce fever. On asking Sheik Ben Nasib how it was that there was so much ague at Tabora—'Don't you see those?' he said, pointing to the rocks; 'these are the cause of it.'"[1] Humboldt remarks that the natives of the Orinoco, in the same way, suppose that the granite rocks "when wet give forth noxious exhalations, and their vicinity is believed to be conducive to the generation of fevers."[2]

An undulating or sloping surface, affording a free discharge to the rains and floods, is thus an important condition of salubrity in a malarious region.

No less, perhaps even more, important is the underground configuration of a locality. The existence of impervious hollows, or of large shallow basins, under the surface, in which the water accumulates, in districts where the surface-soil is dry or even parched, is the cause of intense malaria when the water is near to the surface. Such underground sheets of water are met with in Kordofan and in many of the oasis-lands of North Africa; and they may often exist as the unsuspected cause of the insalubrity of localities that appear outwardly to present all the conditions favourable to health.

All these facts point to the importance of humidity as a factor in determining the distribution of malaria in Africa. It does not matter in what way a humid condition of the soil is brought about, whether it is caused by excess of moisture applied to the soil, or arises from obstruction to its discharge. In Sofala, we have an example of water-logging caused by obstruction to the outflow of streams from the presence of sandbanks at their mouths; in the deltas, reticulated with sluggish streams, water-logging is caused by the deposits brought down from the interior. On the coast and inland plains, the same state of things is brought about by the want of fall to carry off the rains and floods. In many parts of Central Africa, again, we have the rain collecting in underground basins, or in mountain hollows, but the result is everywhere the same. Wherever there is excess of stagnant moisture in the soil or at a moderate distance below the surface, there we find malaria to abound. That this marshy condition of the soil has a causal relation to the prevalence of malaria, is evident from the fact that, in regions such as Uganda, where malaria is not generally endemic, ague makes itself felt in marshy localities, and that on the elevated table-land of East Africa, where endemic malaria is mild, the intenser forms become prevalent in the marshy hollows and valleys. The localisation of malaria in the oases is another proof of the intimate relation between soil or subsoil humidity and the prevalence of malarial fever.

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[1] *Op. cit.*

[2] Humboldt's *Views of Nature*, London 1850, p. 141.

Whether the air or the drinking water be the more common medium by which the malarious contagium, developed in marshy soils, makes its entrance into the system, is a question to which our survey of the distribution of the disease in this part of Africa affords no answer. Pruen's experience points, as we have seen, to the influence of marsh water in the causation of fever. In Africa, drinking water is not conveyed from a distance. The native who uses swamp water consequently lives in a swampy locality, the air of which may be supposed to be contaminated by marsh exhalations. This circumstance must render it difficult, if not impossible, to say whether the contagium is, in any particular case, conveyed by water or air. I am not aware if there are non-malarious marshes in these regions of Africa of which I am treating, but non-malarious marshes are met with in other countries, and the water derived from them does not give rise to fever. If I may be permitted to travel beyond our present sphere of observation for an example of this kind, I might instance the case of the Mâre aux Vacoas in Mauritius. The coast districts of that island are eminently malarious, but the table-land in the interior is non-malarious, and the intervening slopes near the table-land only slightly so. The Mâre aux Vacoas, situated in the centre of the island, has lately been utilised as a water-supply for the inhabitants of the slopes, where malarious diseases are seldom seen. The water of this marsh is highly contaminated by the products of vegetable decomposition, but it has not, I believe, been observed to give rise to fever among the inhabitants of non-malarious localities. If, then, the use of swamp water is a cause of fever, and much could be urged in favour of this view, it should be remembered that it can only produce fever if the marsh from which it is derived is a malarious one. The relative importance of air and water as media of infection, so far as this region of Africa is concerned, must be left an open question.

Cultivation has an undoubted influence in diminishing the prevalence and intensity of malarious disease in Africa as elsewhere. This cannot be ascribed to subsoil drainage, which has proved so effective in banishing fever from many of the aguish districts of England. This refinement in agriculture is unknown in Central Africa. The clearing of the soil from the undergrowth that keeps it moist, the laying it open to the influence of air and light, the dressing of the surface, however perfunctory, for the planting of crops, the removal of the produce, and the drying and aeration of the surface, which even such rudimentary agriculture implies, are found to diminish the prevalence and severity of fever. A well-kept meadow, when the grass is cut, or sufficiently grazed by cattle to keep it low, is comparatively healthy, while a plain where the rank grass is allowed to grow and decay is often highly malarious. It would appear as if the humus derived from the putrefaction of vegetation, if kept moist, and subjected to a high temperature, forms, as it were, a forcing-bed exceedingly favourable for the growth of the malarious contagium. If this be so, we can readily understand that even the most primitive methods of culture will not be without their influence in diminishing the prevalence of fever.

The influence of a high temperature in determining the prevalence of malaria is obvious from the comparative salubrity of the higher lands of Central Africa, and from the diminishing intensity of fever (other things being equal) as we advance north or south of the equator, and also from the greater severity of the disease in places where local conditions, such as those to which we have referred, cause a rise in the temperature. It would lead us too far if we were to enter upon the relative influence of a high mean temperature, of a high summer temperature, and of a high mid-day temperature, on the prevalence of malaria. Some of these points have already been discussed in connection with India.

The seasonal distribution of malaria in the various regions forming the subject of this chapter is pretty well known; but the particular month in which fever attains its maximum, and its periodic evolution in relation to temperature and rainfall, and to the phenomena of flooding and drying, have not been ascertained for any locality.

Roquete states that the most unhealthy season on the Mozambique coast is that which follows the rains, corresponding with the second quarter, when the temperature, always high, is beginning to fall—in other words, to what may be termed the African autumn.

Baines has shown that fever begins to show itself at Laurenço Marques with considerable intensity with the appearance of the rains in October and November. On the Zanzibar coast to the north, the unhealthy season is the same as on the Mozambique and Sofala coasts. On the Middle Zambesi, that is from the Victoria Falls to Teté, the fever season extends from January to June, but whether the maximum is attained in the earlier or later part of this period I have not learned. In the less elevated region west of the Matebele, extending from Lake Ngami to the Zambesi, including the plains of the Chobe and the Barotse valley, fever appears to be most prevalent in summer and autumn—in other words, in April, May, and June, when the waters left by the floods are drying up; and again in October, when the temperature is very high, and before the rains have commenced, and during this period it is most severe in those districts where stagnant pools abound.[1]

Pruen informs us that the worst time for fever on the tableland east of the lakes is that when the first rains begin to fall; that is, in the end of November, in December, or in the beginning of January, according to the distance from the coast.

To the north of the equator, the rainy season is everywhere the fever season, and the fevers appear with the beginning of the rains; but whether their maximum prevalence coincides with the commencement or with the end of the rainy season, has not been determined. Baker, referring to the country of which Kassala is the centre, says "that fevers begin to show themselves with the first appearance of the rains." So far as we can judge from the scanty data available, the period of maximum fever prevalence throughout the region between 10° to 18° N. latitude is the summer and early autumn. In this region the dry and cold season is free from malaria, notwithstanding that the weather towards the end of the dry season is excessively hot. This proves that in a malarious country a high temperature will not develop malaria unless a certain amount of moisture is present in the soil.

Typhoid Fever.—We have no accounts of the occurrence of typhoid fever in the region between Lake Ngami and the Zambesi, nor along the course of the Middle Zambesi; but this is by no means to be looked upon as a proof of its absence. The disease is exceedingly common in the region east of the lakes, especially at the beginning of the rainy season. Pruen's explanation of the prevalence of typhoid fever at this season deserves to be mentioned. "The first showers," he says, "moisten the accumulated refuse lying about, and wash the decaying matter into the nearest stream, which serves as the water-supply of the natives." It is to the use of the water, which is then unusually impure, that he ascribes the greater frequency of the disease amongst the natives at this season. From reports, which Pruen believes to be trustworthy, typhoid fever is very common on the marshy shores of the Victoria Nyanza. The disease was occasionally traced to infection from a previous case; in other instances it seemed as if it could not have been so contracted. Diarrhœa was a common symptom in the cases treated by him.

I have met with only one reference to the existence of "typhus," by which is probably meant "abdominal typhus," as occurring in the vicinity of Jur Ghattas.[2] In Khartum, typhoid fever is stated to be common and very malignant.

Diphtheria.—Diphtheria is not mentioned by Livingstone amongst the epidemic diseases of the Upper or Middle Zambesi. It broke out in an epidemic form at Blantyre among the missionaries of the Established Church of Scotland in 1890, and caused three deaths. Pruen never met with a case either of diphtheria or of croup in the region of which Mpwapwa is the centre.

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[1] Livingstone, *Op. cit.* pp. 194, 509, 249.

[2] Casati, *Op. cit.*

Cholera.—There is no history of cholera having ever visited the Upper or Middle Zambesi, and it is doubtful whether it has extended inland to the lake region or to the table-land east of the lakes. Choleraic attacks were common amongst the Manyuema inhabiting the country east of Lake Tanganyika in 1870, at a period when the epidemic disease was committing great ravages at Zanzibar. It is stated in a footnote in Livingstone's *Last Journals* (page 96), that cholera was introduced on this occasion from the interior of Africa, by way of the Masai caravan route; and it is added, on Dr. Kirk's authority, that it afterwards entered Africa again from Zanzibar, and followed the course of the caravans to Ujiji and Manyuema. This statement, as we have already pointed out, cannot be accepted without confirmation. So far as can be gathered from Livingstone's remarks, the disease observed by him at Manyuema was of a sporadic nature. There is nothing in his account that would lead us to believe that he witnessed an outbreak of true Asiatic cholera. There does not appear to me to be any trustworthy evidence that cholera has ever been epidemic in the plateau south of the Victoria Nyanza, although the northern part of the Masai and the Galla country was visited during the years 1869–70. Cholera penetrated into Khartum, Kordofan, and Dar Fûr in 1837, and it has probably been more or less widely diffused over this region since that time, but the southern limits of its extension are uncertain.

Plague is believed by Pruen to be known in Uganda; but, as he did not himself see the cases, there is, perhaps, room to doubt the accuracy of the observations on which this belief rests. It is certainly not met with in any part of the continent south of the Victoria Nyanza.

Dysentery and *Diarrhœa.*—Diarrhœa is common enough in the region north of Lake Ngami and in the Barotse valley, especially among children; but I do not learn that it is anywhere excessively prevalent or unusually fatal. Dysentery is far from rare in these south-western regions, but it assumes a less malignant character here than in many parts of Africa. In the country lying between the Lualaba on the east and the Lomâmi on the west, and extending from Manyuema south to Bangweolo, forming what may be called the western, or minor lake region, dysentery, of a somewhat more severe type than that observed on the Upper Zambesi, is prevalent. We have already mentioned the frequency of choleraic attacks among the Manyuema in 1870; but this was not an exceptional outbreak, for diarrhœal disorders are endemic in the country. Livingstone remarks that "this region is unhealthy, not so much from fever as from debility of the whole system, induced by cold and indigestion. This general weakness is ascribed by some to maize being the common food, and shows itself in weakness of the bowels and choleraic attacks." Along the shores of the Nyassa and Tanganyika, and on the high lands east of the lakes, dysentery, next to fever, is the most common and most fatal affection, and it frequently supervenes upon fever, and is often the cause of a fatal termination in that disease. Dysentery is even more common, though less fatal, on the interior plateau than on the coast plains; yet this region is much less subject to the graver forms of fever.

We have met with no accounts of the occurrence of true epidemic dysentery in South Central, or East Central Africa.

To what are we to ascribe the extraordinary prevalence of dysentery in East Central Africa? In all inquiries into the etiology of this most important disease, we are met at the threshold by the question, whether more than one affection is included in the group of symptoms to which the term dysentery is applied? That certain epidemics of dysentery, such as those which we have mentioned as occurring in Sweden and Germany, spreading over large regions during a series of years, are due to a specific contagium, cannot admit of a doubt. The similarity, we may say identity, in the symptoms of the epidemic and endemic forms of the disease is certainly in favour of the view of an identity in their nature. On the other hand, dysentery is often so distinctly traceable to chills, to bad drinking water, to coarse or noxious articles of food giving rise mechanically or chemically to irritation of the bowels, to famine, or to some obvious hygienic defects, that many are inclined to regard the disease as a simple colitis induced by climatic, toxic, or mechanical causes, acting most frequently, and with greatest intensity, on those who have been debilitated by fever, fatigue, or want. If there be a simple and a specific form of the disease, clinically they are undistinguishable, or, at least, undistinguished; and not only so, but the same class of agents that are assumed to be the efficient causes of the one is recognised as the predisposing causes of the other. Those who hold most firmly the specific nature of dysentery, are ready to admit that its prevalence is largely determined by those agencies which induce a catarrhal condition of the intestinal canal or weaken the system generally.

Now, all of those agents which, according to the one view, are efficient causes of dysentery, and which, according to the other view, predispose to the disease, are in general operation in East Africa. Sudden and extreme ranges of temperature characterise the climate of the northern part of the Egyptian Soudan, and of the minor lake region of which Lake Kassali may be taken as the centre. These extreme ranges and sudden changes doubtless exercise a very considerable influence in determining attacks of dysentery in districts where the disease is endemic; but they take a very narrow view of the conditions under which dysentery prevails, who look upon it as essentially a "chill" disorder. The difference between the mean temperature of the warmest and the coldest month at Blantyre and Bandawe does not exceed 15° or 16°, while at Lado it is only about 8° or 9° F. This equability of temperature in the last-mentioned locality does not, however, prevent dysentery there from attaining a high degree of prevalence. Bad drinking water is an important factor in the causation of dysentery, and much of the water throughout East Africa is bad, being contaminated in most localities with the products of vegetable decomposition, and in many places with fæcal matters.

The use of some kinds of marsh water are known to give rise to diarrhœa, and the catarrhal condition of the bowels so induced, if it is not itself the first stage in the evolution of dysentery, predisposes to its attack.[1] Whether the marshy water so frequently met with in Africa causes dysentery solely by its irritant or toxic action, or whether it does not also serve as a vehicle for the diffusion of a specific parasitic cause, may be doubtful, but the lesson to be learned by the traveller and foreign resident is to avoid entirely the use of unboiled water; and by the native, that one of his primary objects should be to obtain as pure a water-supply as possible. The importance of this has not yet become apparent to the African, nor need we wonder much at this, seeing how careless more civilised races are in respect to their water-supply.

The alimentation of the natives, no doubt, further tends materially to give rise to bowel affections. Their food is generally coarse and irritating, and is often deteriorated by keeping. They also frequently suffer from scarcity owing to bad seasons, or more often from the marauding incursions of neighbouring tribes. Indigestion is thus an exceedingly common complaint throughout the whole of East

[1] An illustration of the influence of marshy drinking water in causing diarrhœal disorders will be found under the heading of Zanzibar; and the effects of the use of water containing mineral substances which irritate the bowels, in inducing dysentery in a country where it is endemic, will be seen in the incidence of the disease on the different provinces of Algeria.

Africa, and it is aggravated by a scarcity of common salt, the want of which is most severely felt by those who are compelled to live almost entirely on vegetable food. The unhealthy condition of the intestinal canal, brought about by these defects of aliment, must be looked upon as one of the most potent predisposing causes of diarrhœa and dysentery.

A study of the distribution of malarious diseases and of dysentery in East Africa does not support the view that they are due to the same cause. The regions where malaria is most common are not necessarily those where dysentery is most severe. Yet the two diseases are often associated in the same locality. Nor is this to be wondered at, when we remember that a high temperature and a marshy soil are important factors in the etiology of both diseases. Dysentery is also a frequent complication of malarial fever. It is when the patient is worn out by repeated attacks of fever that dysentery steps upon the scene, and administers the *coup de grace* to the sufferer.

Smallpox.—This disease is not endemic on the Upper Zambesi, where it appears only after long intervals in an epidemic form. Livingstone, writing from Linyanti in 1885, says that "smallpox and measles visited the country some thirty years ago and cut off many, but they have since made no return."[1] It appears to be equally rare on the Middle Zambesi. The freedom which these districts enjoy from this disease can only be ascribed to their isolation from centres where it prevails. Smallpox is endemic on the plateau east of the lakes; but here it does not assume that gravity which generally marks its attacks on the African races. Pruen makes the noteworthy statement, that the confluent form is usually recovered from by the natives; and not only so, but that "frequently they have never been ill enough to stay in their beds for one day during the attack." In Uganda and Unyoro smallpox is not endemic, but it occurs at intervals in very destructive epidemies. Referring to Uganda, Wilson says that "it often assumes the confluent type, making thousands of victims." Indeed, according to this writer, so few recover of those who are attacked, that it is seldom that one meets with a person marked by the smallpox. He concludes that it is introduced into Uganda by caravans from the coast. Smallpox is stated to be very prevalent in the Bari villages around Lado, and, as we advance still farther north, we come upon a region stretching through Kordofan to Nubia in which smallpox may be looked upon as endemic.

Measles, as we have seen, appears only at long intervals on the

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[1] *Travels*, p. 504.

Upper Zambesi, and usually along with smallpox. When epidemic, the disease assumes a virulent type.

Pruen did not observe any cases of measles in the Eastern Mountain range, but he is of opinion that the disease is not entirely absent from this region. We are nevertheless justified in saying that few parts of the world are more completely exempt from this malady than South and East Central Africa. Measles is mentioned among the epidemic maladies of Uganda, but at what intervals or with what intensity it occurs it is not stated.

Scarlet Fever, if it occurs at all, which is doubtful, is exceedingly rare in Central Africa.

Whooping-Cough is epidemic from time to time on the Middle Zambesi. As yet we have no accounts of it from any other quarter, but it will probably be found to be epidemic throughout Central Africa.

Dengue is mentioned by Pruen as occurring in East Central Africa, and, curiously enough, as a sporadic affection, traceable, as he thinks, to the use of impure drinking water.

Bronchitis and *Pneumonia* are met with throughout the whole of South Central and East Central Africa. Livingstone notices the prevalence of coughs among the Barotse. Pruen found lung affections to be common among the natives in the Mpwapwa region as sequelæ of fever. Bronchitis, he informs me, is fairly common, pleurisy occasional, and pneumonia rare. Stanley's followers suffered greatly from catarrhs in the Ankori country during the cold, gusty, and variable weather which they there experienced. Wilson enumerates bronchitis among the common complaints of the natives of Uganda; while, according to Hirsch, the negroes in the basin of the Upper Nile are greatly subject to pneumonia.

Phthisis.—Livingstone states that neither consumption nor scrofula exists in the country around Linyanti or in the Barotse valley. So little is known of the pathology of the country east of the Barotse valley, that we cannot say to what extent consumption prevails; but in those districts around and to the east of the lakes, and in the countries south and north of the Nyanza, with the diseases of which we are partially acquainted, consumption takes a very subordinate place compared to that which it holds in Europe. Pruen saw only one case of phthisis in East Central Africa. In Senaar, and in the region to the south of Khartum, phthisis is more prevalent.

Hepatitis does not appear at all common in East Central Africa, and abscess of the liver is also rare.

Venereal Diseases.—So far as is at present known, venereal diseases are rare on the Upper and Middle Zambesi. Livingstone states that he found among the Barotse "a disease called *Manassah*, which closely resembles that of the *fœda mulier* of history."[1] He has unfortunately given us no account of this ambiguous malady. Syphilis has one of its chief centres of prevalence in Nubia, from which it has been widely spread during recent years by soldiers, in the countries bordering the northern lakes. The Wanyoro date its first appearance amongst them from the reign of Kamrasi, some thirty years ago. It is said to have reached them from the east. Syphilis is also excessively common, in all its forms, among the natives of Uganda, and it is far from rare in Manyuema. In the southern lake region, syphilis appears to have been formerly little known, but it has increased of late years owing to more frequent communication with the coast.

Leprosy.—It is not quite certain if leprosy is met with among the Makololo and Barotse on the Upper Zambesi. On the Middle Zambesi, east of Zumbo, Livingstone observed a disease to be common, named *Sesenda*, which he believed to be a species of leprosy. Cameron heard reports of the prevalence of leprosy in the country west of Tanganyika, and it is undoubtedly endemic in the Manyuema country. East of the lakes it is not at all uncommon, occurring both in the anæsthetic and tubercular forms. Pruen remarks that it is hard to see how it can be caused by fish-eating in these districts, seeing that the natives do not use fish as an article of diet, or even as a relish. In Uganda leprosy is known, but it is rare. It is reported, however, to be very prevalent in some of the islands in the Victoria Nyanza, and it is also common in the Upper Nile valley.

Goitre.—We have no accounts of the existence of goitre from the Upper or Middle Zambesi. Cameron reports from hearsay that the inhabitants in the vicinity of Lake Kassali are greatly affected with goitre, and strangers residing among them are also said to exhibit the symptoms after drinking the water a few days. The country here seems to be of limestone formation. Pruen notes the absence of goitre in the mountainous country east of the lakes. It is endemic, according to Hirsch, in a few localities in Senaar.

Rheumatism appears to be a common affection in all parts of Central Africa. In Manyuema it is both common and fatal among the natives. It is also of frequent occurrence on the plateau east of the lakes, where, according to Pruen, it is seldom very acute. It is also of common occurrence in Uganda and in the Upper Nile valley.

Heart Disease and *Dropsy* are not uncommon east of the lakes.

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[1] *Travels*, p. 128.

Dropsy, but from what cause is not stated, is frequent in Uganda. As regards the prevalence of heart disease in other parts of Central Africa, I have learned nothing.

Cancer is extremely rare in all parts of Central Africa. Livingstone never met with a case among the Makololo or the Barotse of the Upper Zambesi.

Ulcers are amongst the commonest native diseases. A special form of spreading sore was observed by Livingstone among the Manyuema. "Irritable ulcers," he says, "fasten on any part abraded by accident, and seem to be a spreading fungus, for the matter settling on any part near becomes a fresh centre of propagation."

Ophthalmia is rife throughout the entire length and breadth of the region of which we are treating, and appears to be specially prevalent at certain seasons of the year, especially before the rains.

Elephantiasis is endemic in the neighbourhood of Bangweolo.

Insanity, exceedingly rare in the country bordering the Upper Zambesi, is somewhat common east of the lakes. Temporary madness, not of a violent character, and lasting for three or four days, is frequently seen among the Wanyoro and the natives of Uganda.

Epilepsy is rare on the Upper Zambesi, but is more frequent to the east of the lakes and in Uganda and Unyoro.

Epidemic Dropsy.—An epidemic, the real nature of which is uncertain, but of which dropsy formed the principal symptom, is described by Livingstone as occurring among the Manyuema in 1870. "Between twenty-five and thirty slaves," he says, "have died in the present epidemy, and many of the Manyuema. The feet swell, then the hands and the face, and in a day or two they drop dead." According to him, this disease came from the east, and was very fatal, few escaping who took it.[1] As no mention is made of paralysis as a symptom in this epidemy, we are scarcely justified in identifying it with true beriberi. These epidemic dropsies deserve careful study.

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[1] *Last Journals*, p. 92.

CHAPTER XII.

ABYSSINIA.

Geography and Climate.—Abyssinia stretches between 7° 30′ and 15° 40′ N. lat., and between 35° and 40° 30′ E. long., having an area of about 200,000 square miles, and an estimated population of three or four millions. A low, hot, and arid tract known as the *Adal* skirts the shores of the Red Sea; but Abyssinia proper consists of a vast table-land, having a mean elevation of about 7000 feet, presenting an abrupt declivity towards the Red Sea, but sloping down more gradually towards the Nile basin on the west and north-west.

The principal divisions of the country are, Tigré in the north, the chief town of which is Adowa; Amhara in the centre, of which Gondar is the capital; and Shoa in the south, the principal town being Ankobar.

The lower plains called the *Kollas*, with an elevation under 5000 feet, are tropical or warm according to altitude; those lying between 5000 and 8000 feet, known as the *Woïna Dekas*, enjoy a temperate climate, while the higher regions, at altitudes of 8000 to 12,000 feet or more, are cold. The Samen Mountains have peaks rising to the height of 15,000 feet. The mean annual temperature at Massowah on the Red Sea is about 88° F.; the rainy season here extends from December until March or April. At Gondar, at an elevation of 7500 feet, the mean temperature of the year is 67° F.; the coldest month is December (62° F.), the warmest, April (73°·2 F.). At Ankobar, at 8300 feet above the sea-level, the mean temperature is 55°·4 F.; the lowest (51°·8) in December, and the highest (62°·0) in June.

On the table-land, the rainy season extends from April or May to September. The annual fall at Gondar varies from 35 to 40 inches.

Pathology.—*Malaria.*—Malarial diseases are by no means uncommon along the coasts of the Red Sea, but the central regions are generally healthy, although malarious *foci* are met with around the marshy shores of Lake Tsana and in some of the valleys. Parkyns says that the "high lands of Abyssinia enjoy probably as salubrious a climate as any country on the face of the earth. At certain seasons of the year, the low valleys, as of Mareb and Taccazzi, especially the former, are much to be feared from the malaria which prevails, and which brings on, in persons exposed to its influence, the most terrible inflammatory fevers, of which four cases out of five prove fatal, and even in cases of escape from death the effects on the constitution are such that it will be years before the sufferer recovers from its shock, if, indeed, he should ever do so entirely." Plowden confirms this statement respecting the salubrity of the high lands in general, and the prevalence of fever in the valleys, particularly in the districts bordering on the Senaar. Meteuma and Kassala, according to Blanc, are among the "most unhealthy spots on the surface of the known world" (*Trans. Med. and Phy. Soc.*, Bombay 1870).

The Abyssinian Expedition of 1867–68 landed in the beginning of December 1867, penetrated to Magdala, and, having effected its object in rescuing the captives, immediately retraced its steps, the last detachment re-embarking on the 5th of June 1868. The troops were thus twenty-five weeks in the country. The British part of the force numbered 2674. The total number of admissions to hospital on shore was only 49·81 per cent. of the strength; the deaths were 35 in all, or 1·30 per cent. of average strength. The number invalided was 333, or a ratio of 12·45 per cent. of the average strength.

Intermittent Fever caused 19·51 per cent. of the total admissions; but it is impossible to say what proportion of the fever cases were contracted on the table-land, and what proportion was caused by relapses of fever contracted on the coast or elsewhere. Two cases of death were all that were ascribed to remittent fever.

Typhoid Fever is frequently met with in Abyssinia, especially during the rainy season. One fatal case occurred among the British troops during the campaign. *Relapsing Fever*, or bilious typhoid, broke out among the troops returning to India from Abyssinia, under circumstances that pointed to its having been contracted in the latter country.

Asiatic Cholera has invaded Abyssinia on several occasions,—first, in 1837; again, to a small extent, in 1855; and, once more, in 1858, when it was more diffused; and finally in 1865, when it caused a great mortality.

Dysentery and *Diarrhœa* are amongst the most prevalent diseases of Abyssinia. The British and Indian troops suffered more from these two complaints than from any other cause during their short campaign in the country, and the former was, in both sections of the army, the most fatal disease. Among the English troops eighteen deaths were caused by dysentery, and the Indian troops were affected by it in nearly the same proportion. In bad cases, its progress was rapid towards a fatal termination, with sphacelation of the bowel. The medical officers ascribed the disease to bad water, coarse, badly-cooked food, and the great alternations of temperature. Blanc signalises diarrhœa and dysentery among the affections endemic in the region surrounding Kassala and Meteuma.

Smallpox is frequently epidemic throughout the country, and it is rare to meet an Abyssinian who does not show marks of the disease. Inoculation is practised by the natives; but vaccination has not been adopted, although Dr. Blanc made efforts to introduce it into the country.

Scarlet Fever and *Measles* occur in Abyssinia, but only at rare intervals.

Bronchitis and *Pleurisy* are moderately prevalent on the tableland of Abyssinia, while *Pneumonia* is decidedly rare. A species of epidemic *Influenza* is frequently observed towards the end of the rainy season.

Phthisis is so rare on the Abyssinian plateau that Dr. Blanc states that he only met with one case of the disease during his sojourn in the country.[1]

Rheumatic Affections are common.

Syphilis is very prevalent among the Abyssinians, so much so, that Dr. Blanc reckons that nine-tenths of the inhabitants are more or less affected with the disease. "Every individual," he says, "male or female, has had, has, or will have syphilis." Condylomata, gummata, ostitis, and affections of the mucous membrane are the most commonly observed forms.

Scrofula is frequently met with.

Leprosy is far from rare, especially in the mountains of Samen and on the shores of Lake Tsana.

Cancer is said by Dr. Petit to be of rather frequent occurrence; but such was not the experience of Dr. Blanc. It is probable that it is unequally prevalent in different parts of the country.

Tænia is very prevalent. Dr. Currie, who writes the medical history of the campaign, gives the following account of the habits of the natives as bearing upon their liability to tænia :—

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[1] Blanc, *Trans. Med. and Phy. Soc.*, Bombay 1870.

"Raw beef is eaten by every Abyssinian, either immediately after the animal is killed and the flesh still warm, or not more than twenty-four hours after it has been killed; meat that has been longer kept is cut up into long sausage-like strips, dried in the sun, and cooked."[1]

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[1] *Army Medical Report,* 1867.

AFRICA.

DIVISION II.

THE AFRICAN ISLANDS.

CHAPTER I.

THE WEST AFRICAN ISLANDS.

The Azores or Western Islands, nine in number, form a group lying between 36° 55′ and 39° 55′ N. lat., and between 25° 10′ and 31° 16′ W. long. They are as follows:—Sta Maria, Saõ Miguel, Terceira, Saõ Jorge, Pico, Graciosa, Fayal, Flores, and Corvo. The total area of the group is 919 square miles, and the population, in 1881, 269,401. The Azores are of volcanic origin, and excepting Corvo, Flores, and Graciosa, they are at the present day subject to volcanic eruptions and earthquakes. The principal towns are Angra in Terceira, and Ponta Delgada in Saõ Miguel.

The climate of this group is mild; the mean temperature of Saõ Miguel being 63° F. (17°·2 C.).

The Azores are healthy; *Malarious Diseases* are rare; *Scarlet Fever* is stated by Hirsch to have been often epidemic in the group.

Phthisis is of rare occurrence; *Goitre* is met with in some localities, and *Leprosy* also exists, but not to any great extent.

Madeira, the principal island in the group of the same name, is situated in lat. 32° 40′ N., and long. 17° W. It is 38 miles long by 12 to 15 broad, with a population of 140,000. The island is of volcanic origin and mountainous, the main chain having an altitude of about 4000 feet, with peaks rising to nearly 6000 feet above the sea-level. Excepting in the south, where it is somewhat arid and bare, the island is fertile and covered with rich vegetation. "Travellers praise the golden splendour of the wide expanses of gorse and broom in blossom, and of the marvellous masses of colour, pink, mauve, and brick-dust red of the flora of the island."

Funchal, the capital, on the south coast, has a population of 15,000.

The following are the mean monthly temperature F.; the daily range, and the rainfall in inches, as given by Piazzi Smyth:[1]—

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[1] *Madeira Meteorologie*, Edin. 1882. We may observe for the sake of comparison with the other islands, which are given in centigrade, that the mean temperature of the year is 19° C.; that of January, 15°·78; and that of August, 22°·55; the range, 5°·2; and the rainfall, 737 mm.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temp., .	60·4	61·2	62·3	64·0	65·0	67·2	71·1	72·6	72·1	69·0	65·8	63·2=66·2
Daily range, .	7·9	9·9	10·8	11·4	11·0	8·3	8·6	8·5	8·6	9·2	8·4	7·8= 9·2
Rainfall, .	4·0	3·1	2·3	2·9	1·4	0·4	0·0	0·0	0·0	5·1	2·0	7·8=29·0

The weight of vapour, per cubic foot of air, varies from 6·5 grains in September, and 6·1 in July and August, to 4·4 and 4·6 in January and February.

The number of rainy days during the year, according to Mittermeyer, is 93. From the middle of May to the end of June it seldom rains, but the sky is cloudy. The sky clears in the beginning of July, and the summer months on to September are fine and rainless. The *leste* or sultry east wind blows for several days together in July and August, but it is much less frequent than in the Canaries.

The climate is remarkably mild and equable, free alike from chilling winds, sudden changes of temperature, and, with the exception of a few days annually, from the scorching east wind, which tries the patient in Algeria and other African health-resorts. The noonday sun is not oppressive, so as to prevent the invalid from taking out-door exercise, and the nights in winter are not so cold as to be unpleasant, or to prevent the rooms being thoroughly ventilated.

This remarkable equability of the climate of Madeira does not depend entirely upon its maritime situation, but is due partly to the equilibrium of the winds—cool winds blowing in summer, and warm breezes in winter. The climate is not a bracing one, but few spots on the earth's surface are so genial and pleasant for the bronchitic or phthisical patient.

Reclus says: " Quand on parle d'un lieu de delices, d'une île heureuse, c'est le nom de Madère qui se présente aussitôt à l'esprit."

PATHOLOGY.—*Malaria* is entirely unknown in Madeira. *Typhoid Fever* is by no means rare, although, according to Grabham,[1] it is not so common as it is in England. It is not confined to any district, but occurs more or less throughout the island. Grabham believes, however, that it is most severe in valleys and low-lying localities.

Yellow Fever has never visited this island.

Cholera has only once appeared in Madeira; this was in 1856, when it was introduced from Portugal, and carried off about 8000 of the population within a short time.

Diarrhœa is a frequent disease among the natives, and it often assumes a severe form. Grabham ascribes its prevalence to unwholesome water, and to food of an inferior quality. The mortality among the infants of the poorer classes from this disease is very great.

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[1] Grabham, *Climate and Resources of Madeira*, London 1870.

Dysentery is generally mild and tractable, but it has at times broken out in destructive epidemics. The *eruptive class* of diseases is milder than in Europe. Severe epidemics of *Whooping-Cough* have been occasionally observed.

Respiratory Diseases are rather common among the labouring classes. *Pneumonia*, of a low and asthenic type, is frequent and fatal among those who are worn out by excessive toil, who inhabit unhealthy dwellings, and who have often to remain in wet clothes. A species of *Influenza*, ascribed by Grabham to seasonal changes, prevails to a considerable extent. It is doubtful whether this disease is of the same nature as the pandemic malady.

Phthisis is rare amongst the upper classes of the natives, but it is not at all uncommon among the poor, especially among the women who work in embroidery.

Tabes Mesenterica is also very fatal among the ill-fed children of the poor; but *Scrofula* is not of frequent occurrence.

Syphilis is widely spread, but is of a mild type.

Leprosy is met with in a few districts, but is gradually dying out.

The Canary Islands lie between 27° 40′ and 29° 25′ N. lat., and between 13° 25′ and 18° 16′ W. long. The principal members of the group are the following:—Tenerife, with an area of 877 square miles, and a population of 112,000; Gran Canaria, 758 square miles, population 80,000; Palma, 718 square miles, and a population of 36,000. The other considerable islands belonging to this group are Lanzarote, Fuerteventura, Gomera, and Hierro. The area of the entire group is estimated at 2800 square miles, with a total population of 280,000. The principal towns are Santa Cruz de Santiago, Laguna, Puerto Orotava, and Villa Orotava in Tenerife; Las Palmas in Gran Canaria, and Santa Cruz de las Palmas in Palma.

The Canaries are nearer to the continent of Africa than any of the other Atlantic groups, and seem to form, as it were, a continuation of the Atlas chain. The islands are destitute of rivers, the streams being simply mountain torrents flowing during the rains, and many districts are only scantily supplied with springs. They have not the same verdure as the other Atlantic islands; in many localities the soil is completely arid.

The following is the mean annual temperature of the year, and of the different seasons, at Puerto Orotava, on the north coast of Tenerife:—

Year.	Spring.	Summer.	Autumn.	Winter.	August.	January.	Range.
20·15	18·96	23·53	21·38	16·75	23·6	16·20	7·4

The average rainfall is about 356 mm. (14 inches); the number of days on which rain falls during the year is from fifty to sixty, and these are mostly confined to the period from November to April.

The climate of the Canaries is a little less equable than that of Madeira; the annual range is higher, the rainfall less, and the east wind from the Sahara blows more frequently.

Malarious Diseases, although of no great intensity, are nevertheless met with in many localities. The soil is composed of basalt or trachyte, covered with volcanic tufa or clay; and as the rainfall is scanty, marshy conditions do not exist at all, or only in particular localities in these islands. It is certainly remarkable that malaria should be developed at all on such a soil.

Yellow Fever has frequently been epidemic in the Canaries. Hirsch records the following years as those when outbreaks have occurred:—1701, 1771, 1810, 1846, and 1862. It is remarked by Lombard that the town of Laguna, situated at an elevation of 1800 feet, has always enjoyed an immunity when the lower lands have suffered from this pestilence.

Cholera has only once made its appearance in this group, viz. in 1857, when it was limited to Gran Canaria.

Plague. — Lombard records epidemics of plague as having occurred in the years 1512, 1531, 1552, 1611, and 1616. He further states that it broke out in the year 1852 at San Christobal de la Laguna, and persisted for more than a year, carrying off 9000 of the inhabitants. It was supposed to have been introduced by carpets from the Levant, which had been used in processions in some infected place; but this mode of introduction was not satisfactorily made out.

Diarrhœal Diseases are frequent. The *eruptive class* of fevers is met with about the same frequency and intensity as in other parts of the world.

Smallpox, which was formerly a frequent and fatal visitor, has seldom been seen during recent years.

Bronchitis and *Pneumonia* are excessively common, but are not correspondingly fatal.

Phthisis is moderately prevalent among the natives. The valley of Orotava and Las Palmas have been recommended as a winter resort for phthisical patients, and the comparatively dry and warm climate of these localities may prove useful in some forms and stages of consumption. Great varieties of temperature and humidity can be obtained at different elevations in the mountainous islands, such as Tenerife.

Rheumatic Affections are common in the group.

Syphilis is prevalent among the civil population.

Leprosy is endemic to a considerable extent. The number of lepers in 1860 is stated by Hirsch at 600, which would give a ratio of about 22 per 10,000 of the population.

The Cape Verde Islands, lying between 14° 45′ N. lat., and 17° 19′ W., form a group comprising Santiago, Fogo, Maio, Bonavista, San Nicolas, San Antonio, Brava, San Vicente, San Luzia, and Sal. They are of volcanic origin, and very mountainous, the highest peak rising to 9157 feet above the sea-level. The total area of the group is about 1400 square miles, and the population (1885) 110,926.

The mean temperature of the year at Praia, Santiago, is 24°·5; that of February, the coldest month, 22°·2; and that of September, the warmest month, 26°·6 C. The rainfall at Praia, in Santiago, is given by Hann at 323 mm., and is thus distributed:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1	0	0	0	0	12	103	136	49	3	18

Pathology.—*Malaria.*—The only islands in the group that are free from malaria are Antonio and Brava; the others suffer from endemic fevers to a considerable extent. The island of Maio, an account of the pathology of which is given by Hopffer,[1] consists of a silico-calcareous soil, which rapidly absorbs the rains; but permanent salt marshes, and temporary fresh-water marshes, and mixed marshes, containing salt and fresh water, exist along the shores. The permanent *marais salants*, when well kept, are not unhealthy; but Hopffer found them to be badly kept in Maio, and to be prejudicial to health. The temporary mixed marshes which are developed during the rains are, however, the most dangerous; and it is these that Hopffer regards as the principal source of the malaria which is so prevalent in the island. It appears, however, that malaria is not confined to marshy localities, although these suffer most. Malarial fevers, mostly intermittent in type, formed about 10 per cent. of the cases seen by him. Out of twenty-one cases of fever there was one of the remittent form, and one of pernicious syncopal fever. The malarial cachexia is common, and most of the inhabitants suffer from enlargement of the spleen, often complicated with anæmia and anasarca. Summer and autumn are the seasons when endemic fevers are most prevalent.

Yellow Fever has been epidemic on three occasions in this group, viz. in 1845, 1862, and 1868 (Hirsch), but it has always spared the island of Maio.

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[1] Hopffer, *Notes sur la Topographie-médicale de l'île de Mai*, *Archiv. de méd. nav.* vol. xxvii.

Cholera was introduced into Fogo from Italy in 1855–56.

Dysentery enters largely into the pathology of these islands, being specially severe along the coasts. The islands of Santiago (*la mortifère*) and San Nicolas suffer most from this disease, while San Antonio is affected in only a minor degree.

Diarrhœa is also prevalent in summer.

Bronchitis, catarrhal affections generally, and *Pneumonia*, are all remarkably frequent. "They are the maladies of all seasons and of all localities," constituting one of the leading features in the pathology of the group.

Phthisis is rare in the island of Maio, but this, as Hopffer remarks, is not to be taken as indicating any antagonism between tuberculosis and malaria, for consumption makes many victims in the islands of Santiago and Fogo, where malaria is also endemic.

Rheumatism and *Rheumatic Affections* are of such frequent occurrence, that the numerous necropsies made by Hopffer almost always revealed traces of cardiac complications, such as pericarditis or endocarditis.

Hepatitis of a subacute or chronic form, and congestion of the liver, are frequently observed in this group.

Venereal Diseases are not so common in Maio as in the other islands of the Archipelago.

FERNANDO PO is situated in the Bight of Biafra, about 20 miles from the mainland. It is 44 miles long by 20 broad, and is traversed by a mountain range, which, in Clarence Peak, attains an altitude of 10,650 feet.

The annual mean temperature is 25°·6; that of September, 23°·6; and that of January, 27°·7 C. The rainfall, according to Hann, is 2557 mm., which is distributed as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	93	230	210	213	280	162	282	420	392	222	28

Simple intermittent fever is the prevailing disease. Bilious remittents and pernicious attacks are much less frequent. The malarial cachexia is general.

Dysentery and *Hepatitis* are of frequent occurrence.

Lymphangitis, frequently ending in suppuration, is remarkably common. European women residing in the island suffer greatly from uterine hæmorrhage.[1]

Pneumonia is common, and *Phthisis* is also frequently met with.

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[1] Pardo, *Observaciones sobre las fiebres de Fernando Pò*, Ferrol 1887.

St. Thomas, 260 miles south-west of Fernando Po, is less malarious than the mainland. The intermittent type is that most frequently observed, yet it would appear that the severer forms are not unknown. Lind records that in 1766, the *Phœnix* ship of war, returning from the coast of Guinea, touched at this island. The officers and men had up to that time been in perfect health. Nearly all landed, and sixteen remained on shore for several nights. Every one of them contracted fever, and thirteen of them died. The rest of the men, numbering 280, went on shore in parties of twenty or thirty during the day, but returned to the ship at night; *these* all escaped the fever.

Phthisis is stated to be widely prevalent and fatal among the negroes.

Ascension, situated in the South Atlantic in 7° 57′ S. lat., and 14° 21′ W., is 7½ miles long by 6 broad, having an area of 35 square miles. It is of volcanic origin, and rises, in the Green Mountain, to a height of 2870 feet.

The water-supply, derived from the mountain, is pure.

The temperature of the year is 25°·3; that of September, 23°·4; and that of March, 27°·1 C.

The climate is, upon the whole, healthy. *Malaria*, if not entirely absent, is not severe. *Typhoid Fever* has been observed in the island. *Yellow Fever* has been twice epidemic, viz. in 1823 and 1837.

St. Helena, situated in 15° 55′ S. lat., and 5° 42′ W. long., is 10½ miles long and 7 broad, with an area of 47 square miles, and a population of 5085. The island is of volcanic origin, rugged and mountainous. Diana's Peak in the centre has an elevation of 2700 feet.

The mean temperature of the year is 21°·3; that of August, 18°·7; and that of February and March, 23°·9 C. The mean annual rainfall is 1112 mm.

Malarious Diseases are unknown in St. Helena. Not a single death from any miasmatic affection occurred among a force from 300 to 400 strong during the period 1859–65. *Typhoid Fever* is rather frequent, but is not usually of a severe type. *Diphtheria* was epidemic in the island in 1824. Since then nothing has been heard of the malady (Hirsch). *Diarrhœa* and *Dysentery* are amongst the more common and fatal diseases of the native population, and they are by no means rare among the troops stationed in the island. Lombard gives the mortality from dysentery at 42 per 1000; that from diarrhœa at 29 per 1000, of the deaths from all causes. *Hepatitis* causes 29 per 1000 of the total mortality. The *Eruptive Diseases* are seldom met with in the island. *Measles* was epidemic in 1718, and again in 1807, and it does not appear to have occurred since that time. *Smallpox* had not been observed in the island up to the year 1836, and Hirsch had met with no accounts of its appearance up to 1881. *Scarlet Fever* is equally unknown in St. Helena.

Respiratory Diseases are rather common and fatal, forming, according to Lombard, 92 per 1000 of the total deaths; while *Phthisis* gives rise to no less than 105 per 1000. The admissions among the troops for tubercular diseases during the period 1859–66 were in the ratio of 6·6, and the deaths of 1·66 per 1000; as against the annual death-rate per 1000 (1872–80) of 2·29 of the troops on home service. We conclude, therefore, that phthisis is less fatal to Europeans in St. Helena than in England. *Scrofula* is by no means rare. *Leprosy* appears to be known in the island, but to what extent it prevails I have no means of knowing.

CHAPTER II.

THE LESSER EAST AFRICAN ISLANDS.

ZANZIBAR is a small island lying about 30 miles off the east coast of Africa, six degrees south of the equator. It is 48 miles long and from 15 to 30 miles broad. It is of coral formation, low, level, well watered, and fertile. According to Burton, the interior tends to become marshy after heavy rains. The subjoined table gives its average mean temperature, with the daily range and the monthly rainfall, for 1883:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature, .	83·5	83·5	83·3	81·5	78·6	78·4	77·2	77·4	77·5	79·2	79·9	81·7
Daily Range, . .	4·5	5·4	5·0	2·9	2·0	3·2	3·6	3·1	4·1	4·0	2·0	3·6
Rainfall, . . .	2·49	5·73	2·01	11·65	6·59	0·00	7·21	0·53	1·13	1·05	3·16	0·83

PATHOLOGY.—*Malaria.*—The island of Zanzibar, although by no means free from malaria, does not deserve the bad reputation, as respects fever, which it has received. It is certainly much more healthy than the adjacent coast of the mainland. Drago[1] remarks that, with its madreporic subsoil, Zanzibar enjoys to some extent the same immunity from paludism as the islands of the Pacific having a similar formation. The fevers met with, whether among the Swahili, the Indians, the Arabs, or the Europeans, are generally of a mild type. The interior of the island is more unhealthy than the coasts. The remittent form is rarely seen. Fevers are most prevalent in June, July, and August.

Typhoid Fever ought to be prevalent in Zanzibar if pythogenic conditions could cause it; for the total neglect of all sanitary considerations and precautions has been commented on by all travellers. New states that "the city is almost surrounded by deep lagoons, over which the water flows and returns at every tide, leaving a fœtid plain reeking with the most pestiferous vapours. A dreadful effluvium arises from the sea-beach at low tide, occasioned by the oozing of filth from the sands." Yet, notwithstanding these conditions, Drago informs us that typhoid fever has not yet been observed in Zanzibar. Perhaps it would be safer to say that it has not yet been recognised—and this itself is a proof that it is comparatively rare.

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[1] *Archiv. de méd. nav.* vol. liv. 1890.

Dengue was epidemic in 1871, when it was observed and described by Christie, under the native name of *Kidinga Pepo.*[1]

Cholera, as we have already seen in treating of the mainland, has repeatedly been introduced into Zanzibar. In 1859, according to Daullé, the deaths out of a population at that period of from 150,000 to 200,000 numbered 20,000. In 1869–70 the disease was less fatal.

Diarrhœa was formerly excessively frequent among the crews of the merchant ships visiting Zanzibar, the water at that time being derived from muddy wells near the town. An excellent supply has now been brought from the interior, and the result has been a great diminution in the frequency of the disease among the sailors visiting the port. Diarrhœa is, however, one of the commonest diseases among the natives.

Dysentery is severely endemic in Zanzibar. It shows itself frequently during the warm season, and affects by preference the Banians, whose alimentary regimen is debilitating.

Hepatitis and *Abscess of the Liver* are exceeding rare; indeed, according to Drago, they are almost unknown.

Smallpox and *Measles* are endemic in the island, and are at times epidemic; the former is particularly fatal among the natives.

Scarlet Fever appears to be unknown in Zanzibar.

Bronchitis and *Pneumonia* are less common than in Europe, yet they are rather frequent in the months of March and April.

Phthisis, according to all observers, makes great ravages among the female population of the harems, and among the Indian women, who live in badly-ventilated houses. Amongst the other classes it is much less frequent.

Syphilis may be said to be truly endemic in Zanzibar. Loustalot-Bachoué[2] reckons that five-sixths of the natives suffer either from the hereditary or the acquired disease, which frequently manifests itself in phagedenic ulcerations, affecting the skin and mucous membranes. A disease known as *Yaws*, but which is probably a form of endemic syphilis, spread by the ordinary intercourse of social life, is common among all classes, affecting chiefly children under ten or fifteen years of age. It seems to be identical with the *tety* of Madagascar.

Elephantiasis is excessively common. It is estimated that at least 20 per cent. of the inhabitants suffer from this malady.

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[1] *Trans. Bomb. Med. and Phy. Soc.*, 1871.

[2] Loustalot-Bachoué, *Étude sur la constitution physique et médicale de l'ile de Zanzibar*, Paris 1876.

Ulcers of the extremities, of a spreading and obstinate character, are notably prevalent amongst the negro population; they obtrude themselves upon the notice of the traveller at every turn.

Leprosy, principally of the tubercular variety, is widely diffused among the coloured population.

PEMBA is a small island lying to the north of Zanzibar, and differing little from it as regards climate or pathology. Dr. Underhill, of H.M.S. *Boadicea*, and thirteen of the men belonging to one of the boats, were compelled to sleep on shore, in the open, for one night. Four of the party were seized with the ordinary remittent of the coast, after the lapse of twelve days, although the boats often lie off the land at a distance of 100 yards or so, for nights on end, without the men contracting fever. This illustrates the dependence of fever on the soil, rather than on the climate, and also indicates its period of incubation in such circumstances in this locality.

COMORO ISLES, a group of volcanic islands in the Mozambique Channel, consisting of Angaziya or Great Comoro, Anjouan or Johanna, Mohilla, and Mayotta. The population of the entire group is about 65,000.

The mean annual temperature of Mayotta is 25°·4; that of winter, 26°·5; and that of the dry season, 24°·3 C.

In Great Comoro, *Malarial Fever* is scarcely known; it is of more frequent occurrence in the island of Johanna, and prevails with great severity in Mayotta, where it often assumes the remittent form, especially in strangers. The intermittent is observed to attack by preference those who have been long subjected to malarious influences. The attacks often come on at intervals of fifteen or twenty days, sometimes only once a month.

Dysentery is severely endemic in Great Comoro, is somewhat less prevalent in Johanna, and is common in Mayotta among the natives, but less so among the Europeans.

Cholera was epidemic in this group in 1859.

Smallpox and *Measles* appear in an epidemic form, the former occasionally and the latter frequently.

Phthisis is very common in Great Comoro among those women who are secluded; and chest diseases generally are far from rare among the natives. *Beriberi*, which is here known as *N'dhui*, is stated to be frequently met with in Great Comoro. *Venereal Diseases* are widely prevalent.

CHAPTER III.

MADAGASCAR AND SEYCHELLES.

MADAGASCAR.—GEOGRAPHY.—This important island lies between lat. 11° 57′ and 25° 38′ S. It extends for about 1000 miles from north to south, its greatest breadth being 350 miles, with an area of 225,000 square miles, and a population of from three to four millions. The south-western part of the island is comparatively level, but the interior, throughout a great part of its extent, rises into an elevated table-land from 2000 to 5000 feet above the sea-level. The east and west coasts are skirted by a belt of low land of varying width. To this succeeds an undulating grassy country, bounded towards the interior by hills covered with dense forest. The central plateau is generally treeless, and covered with grass, except in the valleys, where rice is cultivated. The soil on the coast is alluvial. In the interior a red clay predominates over a large part of the country. The island is watered by numerous rivers and streams. One of the principal rivers is the Betsiboka, which, rising in the range of mountains bounding the table-land on the east (which forms the watershed throughout the greater part of the island) and in the Anakaratra Hills to the south, passes Antananarivo, the capital, where it is known as the Ikopa, and after a lengthened course to the north-west falls into the sea at Bembatoka Bay. Other large rivers, some of which form considerable deltas, fall into the sea on the west coast. On the east, the streams are very numerous, but have a short course, rising as they do in the eastern range. In the interior many lakes exist, but these are of no great extent. Along the east coast there are extensive lagoons, separated from the sea by land varying from a few yards to one or two miles in width. We have thus a coast zone of level or undulating country, then a forest zone, and finally the great central plateau, which is diversified by hills, some of which, as those of the Anakaratra range, attain an elevation of 8000 to 9000 feet.

CLIMATOLOGY.—The only parts of the east coast for which we have meteorological observations are the French island of St. Mary and the port of Tamatave. Lombard gives the mean annual rainfall of the former at 2646 mm. I subjoin the mean monthly rainfall, in inches, of Tamatave from October 1880 to September 1881, and from January to September 1882:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall,	13·02	11·62	6·46	11·35	2·19	8·52	13·45	7·41	5·21	4·18	5·20	6·33

For Diego Suarez, on the north, the temperature C. and rainfall are given thus:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temp. 6 A.M.,	25·3	25·0	25·3	25·1	24·3	22·8	21·6	20·6	22·3	23·9	24·5	25·2
,, ,, 1 P.M.,	29·8	28·9	29·1	29·4	28·7	27·6	26·6	25·9	26·9	27·8	28·3	28·8
Rainfall, ...	0·382	0·093	0·071	0·011	0·000	0·009	0·028	0·000	0·000	0·006	0·008	0·119

At Nosi-Bé, off the north-west coast, the dry season extends from April to October, the rainy season from November to March. The temperature at Nosi-Bé is wonderfully equable, oscillating between 25° and 31° C.

For Antananarivo, the capital, on the central table-land, at the height of nearly 5000 feet, the mean monthly temperature F. for 1882, and the average monthly rainfall, in inches (1881–85), are as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature, F.,	72·84	69·76	67·88	67·49	64·48	60·58	62·73	58·22	62·03	66·87	71·14	71·06
Average Rainfall, in.,	14·23	9·04	7·31	1·37	0·79	0·25	0·18	0·34	0·73	3·55	5·62	9·13

PATHOLOGY.—*Malaria.*—The north-eastern shores of the island near Vohimaro are comparatively healthy, but fevers are prevalent at the new French port of Diego Suarez in the north. The more elevated parts of the south coast suffer but little from fever. Fever is endemic along the east and west coasts, and in the islands near to the shore. Both on the coasts and on the islands it manifests a high degree of intensity, especially among Europeans and the Hovas belonging to the central province of Imerina, when they visit the low country. The coast tribes, however, enjoy a comparative immunity from the disease.

The French island of St. Mary, on the east coast, deserves the evil repute which it has obtained since its first occupation.

The forest zone is not exempt from malaria, which is met with especially in the humid valleys, such as Beforona, which are more or less shut in by mountains.

The valley of Angavo, again, although at an altitude of about 3000 feet, is excessively malarious; the natives, who are here mostly of Hova origin, suffer severely from the malarial cachexia.

In the bare, open, central province of Imerina, at an elevation of 4000 to 5000 feet, as well as in the Betsileo country to the south, fever is not endemic; but to the west of Imerina, in the Vonizongo district, where the elevation is less, and the country level, grassy, and in parts marshy, almost every one suffers from enlargement of the spleen. This organ is not unfrequently found to stretch across the abdomen to the right iliac crest. The malarial cachexia is very general here, while frank attacks of fever are rare. The Antsihanaka country, to the north of the capital, especially in the neighbourhood of the Alaotra Lake, is highly malarious.

Segard,[1] whose experience was chiefly confined to the east coast, found the tertian type of fever to be the most common; the stages were well marked at the beginning, but became irregular in the relapses, which rapidly induced anæmia and debility. Bilious fever, he says, was characterised by violent headache, suffusion of the face, redness of the eyes, marked gastric catarrh, excessive vomiting, bilious diarrhœa, pain in the region of the liver and gall bladder, high fever with feeble morning remissions, followed by a long convalescence. He also observed the bilious hæmaturic form, and a considerable number of pernicious cases—mostly of the comatose variety. He observed two cases of mania with hallucinations in persons suffering from fever. The lymphatic glands often became enlarged. He noticed also in some cases a generalised measly eruption to accompany the fever, and urticaria was very common.

The months most charged with fever cases were January, February, and March—that is, during the rainy season—February and March being the worst, and almost equally unhealthy.

At Diego Suarez, out of 1563 cases admitted into hospital,[2] 1024, or 65 per cent., were for malarious diseases. The deaths occasioned by these diseases amounted to 46 per cent. of the total deaths; most of the pernicious cases were of the comatose form. The most common form of fever here is the intermittent, and the most common type of intermittent is the quotidian. The intermittent variety is most frequent in March, April, and May; the remittent in January, February, and March; but the greatest number of deaths from this form occur in March and April.

The seasonal prevalence of malarial fevers in the aggregate will be seen from the following table, which gives the number of cases of fever per 100 of patients treated in hospital from June 1866 to December 1867:—

June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
65	67	50	35	43	66	38	71	61	92	95	81

June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
65	54	20	20	27	44	48

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[1] *Arch. de méd. nav.* 1886.

[2] Cartier, *Arch. de méd. nav.* 1888.

The remittent is the most common form among the new arrivals. The bilious hæmaturic fever is also met with, and the cases of this fever are not limited to any season.

Nosi-Bé, on the west coast, with its rocky and clayey soil, with its climate, which, according to Barnier, "is perhaps of all countries that where the variations of temperature are the least accentuated," is nevertheless one where malaria is the predominating disease. Of 2674 cases of endemic disease treated at Nosi-Bé from 1862 to 1880, no less than 2600 were due to malaria, and 44 to liver disease, which may or may not have had a malarious origin.[1] The following figures show the number of cases treated, and the deaths from malarial affections and diseases of the liver, in the different races:—

	TREATED.	DIED.		
	Number.	Europeans and Creoles.	Other Races.	Total.
Malarious Diseases, ...	2600	124	9	133
Liver Diseases, ...	44	0	5	5

The 2600 cases of malaria are thus classified:—

	Cases Treated.	Died.
Malarial Fever, ...	2063	72
Pernicious Fever, ...	197	
Ictero-hæmaturic Fever, ...	185	49
Anæmia, ...	76	1
Cachexia, ...	91	11
Enlarged Spleen, ...	6	0
	2600	133

Guiòl states that at Nosi-Bé the quotidian type is the most frequent; next follows the tertian, which, however, is often consequent on the quotidian, but which in many cases is the initial form of attack. Among the pernicious forms, those in which there is a determination to the cerebro-spinal centres are the most frequent; next come those cases in which there is an exaggeration of the phenomena of depression; then, those in which abdominal symptoms or excessive reaction predominate. There was only one case out of 179 of pernicious fever in which pulmonary symptoms occurred.

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[1] Guiòl, *Arch. de méd. nar.*

In order the more clearly to show the nature of the fever met with in Madagascar, I shall briefly narrate the results of a journey of a party of missionaries from Bétafo, in the interior, to Mananjara, on the east coast, at a fairly healthy season of the year.

The party numbered thirty-two in all, and consisted of eight adults and twenty-four children, of ages varying from one to sixteen years, and generally in good health. None of the children, and only four or five of the adults, had previously suffered from fever. The journey occupied seven days, in the end of September and the beginning of October. The weather was dry throughout. The road for a considerable part of the way lay through forest and near to streams, but not through, or near to, any extensive swamps; and the party was not subjected to any unusual fatigue or hardship by the way.

The whole party arrived at Mananjara in good health. Four or five took ill on the third day after their arrival; some remained well for nine days, others for a period of three weeks or longer. In those that took ill three days after reaching Mananjara, the period of incubation could not have exceeded three or four days, inasmuch as for the first day or two the route is through a healthy country. In most instances the fever by which the party was attacked was of a remittent or pseudo-continued form, characterised by high temperature, lasting from three to seven days, without any intermission or even marked remission, accompanied by severe bilious vomiting, and in some instances by bilious diarrhœa. During the continuance of the fever there were partial sweats, affording no relief.

In one case—that of a child four years of age—towards the end of the attack there occurred rigidity of the limbs, with pain, so that it could not bear to be touched or moved. Following upon this condition, an algid attack set in, the whole body becoming like ice; even the breath seemed cold. The algid symptoms disappeared, and along with them the fever, leaving the patient helplessly weak. After a month's respite, in this instance, intermittent fever appeared. In another case, bilious fever became converted into the intermittent form, and although the patient seemed better and had recovered his appetite, swelling of the feet and giddiness ensued. In most instances, a fortnight or three weeks of freedom from fever followed the bilious remittent attack; but sooner or later intermittent fever of a tertian or irregular type supervened. In the case of one or two of the sufferers, the fever began as an intermittent of the quotidian type, which later on changed into tertian. In one instance the primary form of attack was intermittent, and the relapse remittent accompanied with diarrhœa.

After leaving Mananjara for Mauritius, one of the party, an adult, died of fever during the voyage. On reaching Mauritius, in the middle of December 1886, several of their number were anæmic and weak, with enlargement of the spleen, and continued to have frequent attacks of intermittent fever. One child had to be admitted to hospital for ulcerative stomatitis affecting the bones of the face.

To sum up, twenty out of the thirty-two who performed this short journey contracted fever in one form or another; and although only one died, many of those who had been attacked with fever and survived were left in a state of great debility and anæmia. The whole history appears to me to show that the same cause produces alike the bilious remittent and the intermittent forms of fever.

The first attacks of the fever contracted by the Hovas are generally severe. Those who survive are said to be "vaki-tazo," or broken to fever, and those so broken are selected in preference to others for trading and other purposes in the low country; not that the "fever-broken" secure any immunity from relapses, but it is held, and I think justly, that the subsequent attacks in their case will be of a less dangerous character. Although the Central Provinces are singularly free from endemic malaria, they were visited during the years 1877, 1878, and 1879 by a remarkable epidemy of fever that deserves notice.

Dr. Güldberg, of Christiana, who resided long at the capital, witnessed this epidemy; and it is chiefly on particulars supplied by him that the following account of it is based.

During the seven years Dr. Güldberg resided at Antananarivo, he treated 1435 cases of malarial fever. Of these—

111	cases were seen in	1877.
342	,,	1878.
889	,,	1879.
1342		

During the four years 1883–86, he had only met with 93 such cases, and these had doubtless been contracted either on the coast or in the Vonizongo district. The epidemy began in 1877, reached its height in 1879, but in 1880 a certain amount of malarious disease was still observed to prevail, from February to May or June, in certain low-lying districts, though after 1879 it was seldom fatal. It will be remembered that 1879 was a year when fever was widely prevalent in India and Cyprus.

The disease was generally prevalent all over the Central Province,—in the south among the Betsileo, in Imerina among the Hovas, and in the north among the Antsihanaka. It did not extend to the feverish districts of the east coast. From the other districts I have obtained no accounts. Nor am I able to say where it originated. The information I have received makes it probable that it first appeared in the Betsileo country, to the south, and extended northwards; but this is not quite certain. The nature of the epidemy was what may generally be described as bilious remittent. At first I thought that it might have been an outbreak of recurrent fever or of the bilious typhoid of Griesinger. This, however, does not appear to have been the case. All the medical men who witnessed it concur in regarding it as malarial.

In mild attacks it began with rigors; but in serious cases these were absent. The fever lasted from four to seven days, was accompanied by intense headache, pains in limbs, loins, nape of neck, and pit of stomach, with bilious vomiting, and sometimes with diarrhœa—simple or sanguineous. Sub-delirium was often present. In the worst cases, jaundice occurred. There were morning remissions, with exacerbations in the afternoon or evening. During the exacerbation there were great heat of skin, and hurried respiration, followed in the milder cases by sweating. This series of phenomena was repeated daily, and in a certain number of cases terminated in a frank intermittent. The fever was liable to relapse—and these relapses generally occurred about a week or a fortnight after recovery from the first attack. Such relapses were liable to recur repeatedly. Dr. Güldberg notices the frequency with which enlargement of the spleen was observed in patients who had suffered from the fever. It is not stated whether the relapses were of a remittent or of an intermittent type. In favour of the view that this epidemy, which was certainly very fatal in many districts, and respecting which it is to be regretted that no more precise information can be obtained, was malarial in its nature, may be mentioned the distinctness of the remissions, its tendency to merge into genuine intermittent fever, its repeated and irregular relapses, the consecutive enlargement of the spleen and the cachexia, its preference for low, damp localities, and the recurrence of the epidemy at a certain season of the year.

Typhoid Fever is, so far as I know, rare in the low country, but it is one of the most common diseases of Imerina (the Central Province), where it was well known by the natives, and distinguished from malarial, or country fever (tazo antsaha), as threshold fever, or tazo andrindrin. As observed in the capital, typhoid fever follows its classical course.

Typhus Fever is quite unknown. *Diphtheria*, as an epidemic malady, is never seen in the Central Province, and I have never heard of it in the low country. I have witnessed only a few sporadic cases of membranous laryngitis.

Erysipelas is very uncommon, at least in the capital. I can scarcely recall above a few cases of the disease.

Cholera broke out, for the first time, at Nosi-bé, off the west coast, and on the adjacent mainland of Madagascar, in 1859. It was introduced from Mozambique, but it certainly could not have spread to any extent, and it has never reached the centre of the island or the east coast.

Dysentery is endemic along the coast-line. At Diego Suarez, dysentery is one of the most fatal diseases, and is apparently most common from July to October. On the east coast the disease is moderately frequent, but in certain years it becomes so general as to be justly regarded as epidemic. The Hova troops during the late war, encamped west of Tamatave, suffered greatly from this disease. On the central table-land acute dysentery is upon the whole rare.

Diarrhœa, simple and inflammatory, and *Cholera Infantum*, are both remarkably common in the capital; the latter is only met with during the warmest months.

Smallpox (*nendra*) has frequently spread all over the island in murderous epidemies. Whether it is really endemic in the country, is doubtful. The native name for the disease points to its introduction from the Swahili coast. Its frequent outbreaks in past years were generally connected with the introduction of slaves from Africa. *Measles* breaks out in an epidemic form at intervals of a few years. It not unfrequently assumes a severe type, and carries off many victims. It often becomes complicated with bronchitis and broncho-pneumonia. *Scarlet Fever* is entirely unknown. *Influenza* broke out at Antananarivo in June, July, and August 1890. It was frequently followed by fatal pneumonia.[1]

Bronchial Affections among adults are comparatively rare; but during the cold season acute bronchitis and broncho-pneumonia carry off many of the native children. *Pneumonia* is at least as frequent among the natives of Madagascar (in the interior) as it is in England. On the coast, from what I have observed, acute respiratory diseases are less frequent than in the interior. *Phthisis* is far from rare in Imerina, and runs a rapid course. It is by no means prevalent on the coasts. *Acute Rheumatism*, so far as I can judge, is not a common disease among the natives, although muscular and syphilitic rheumatism are very common. *Syphilitic Diseases* are widely diffused, especially throughout the Central Province. No disease is more commonly met with than the condylomatous affection called by the natives "tety." It appears chiefly at the mucous orifices and axillæ as mucous patches. It usually affects children under the age of puberty, and when one takes the disease it spreads to all the members of the family who have not already had it. It is followed in many instances by the constitutional symptoms proper to syphilis—periostitis, phagedænic ulcerations of the skin and mucous membranes, destruction of the soft tissues of the throat, and sometimes of the bones and cartilages of the palate and nose. The women who have suffered from the disease in childhood often suffer from abortion, or give birth to syphilitic children.

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[1] *Report on the Medical Mission for* 1890, Antananarivo 1891.

As in the Lithuanian syphilis, it is rarely, if ever, possible to trace any initial hard sore, or to obtain any history of one. This form of disease is seldom propagated by sexual intercourse.

Leprosy is widely prevalent in all parts of the island with which I am acquainted, and is met with amongst all classes.

Gravel and *Stone* are exceedingly common in the Central Province, but much less so in the rest of the island. *Gout* is a common disease among the rich officers, who live well and take little exercise; but it is seldom seen amongst the common people.

Diabetes is comparatively rare, although cases are occasionally observed.

Beriberi was observed in an epidemic form at Diego Suarez in 1866 and 1867, when it caused a considerable mortality. It is not endemic in the country generally, although I have observed some three cases in the capital, which presented all the symptoms of the acute disease, and all of which ended fatally.

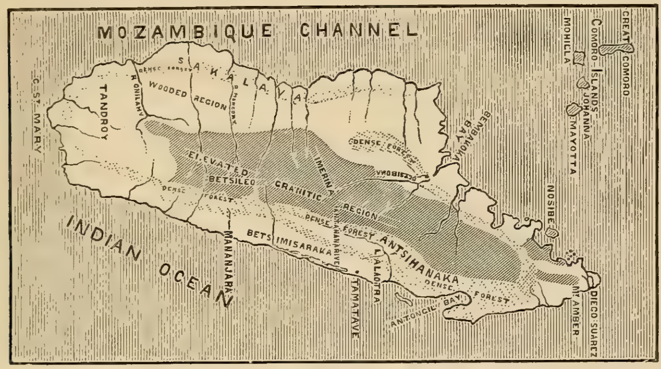
I have just received a report of the Medical Mission at Antananarivo for the year 1890, published by Drs. Fenn and Moss. As the pathology of the central table-land of Madagascar is highly interesting, I shall briefly analyse the figures there presented. The cases of disease treated in the hospital, excluding surgical and obstetric cases, numbered in all 429. These may be thus classified:—

General Diseases, ...	122	Heart Diseases (functional), . .	4
Diseases of the Respiratory System,	100	Diseases of the Alimentary System,	94
Phthisis, ...	14	Diseases of the Liver, . . .	20
Heart Diseases (organic), . .	61	Diseases of the Nervous System, .	14

The percentages furnished by some of the more important diseases were :—

Pneumonia,	12·3	Dysentery,	3·0	Typhoid Fever,	1·7	Organic Heart Disease,	14·2
Bronchitis,	8·4	Diarrhœa,	6·3	Intermittent ,,	10·2	Acute Rheumatism, .	0·47
Pleurisy, .	0·7	Enteritis,	0·7	Remittent ,,	10·0	Chronic ,, .	1·17

The reason that syphilis does not appear in this table is that it is not generally an hospital disease, and, for the same reason, diarrhœa, unless severe, would be treated in the dispensary. These figures must not, therefore, be taken as indicating the absence of the one, or the comparative rareness of the other. Indeed, syphilis, as the report truly says, is all but universal. The extraordinary prevalence of organic heart affections cannot be explained by any corresponding prevalence of acute rheumatism. Nothing struck me more in Madagascar than the extraordinary prevalence of heart disease, of uric acid deposits in the urine, of stone in the bladder, and the prevalence of syphilitic diseases to which I have already alluded. Pneumonia, although common, does not, as a rule, furnish such a large proportion of cases as it did in 1890, when influenza was epidemic.



MADAGASCAR.

For an account of an epidemy of choreamania in Madagascar, see *Edin. Med. Jour.* 1867.

THE SEYCHELLES ISLANDS.

The Seychelles Islands lie between 3° 40′ and 5° 35′ S. lat. The principal islands of the group are Mahé and Praslin. Mahé, which is 18 miles long by 3 to 5 miles broad, is mountainous and fertile. The population, which is chiefly gathered round the coast, numbered in 1889, 16,162. The majority of the population consists of negroes.

The subjoined table gives the mean temperature F. and rainfall in inches for Mahé:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average Mean Temperature for 1880, 1881, and 1884, . .	77·2	79·6	79·8	80·5	79·4	78·0	75·6	76·8	77·7	78·4	77·8	79·0
Average Rainfall for 1880, 1881, 1883, and 1884, .	16·18	9·52	13·01	7·78	6·91	3·43	1·02	1·32	7·83	9·33	8·84	15·10

The Colony is an eminently healthy one, as will be seen from the annual death-rates from 1880 to 1887—

1880, . .	15·3	1884, . .	17·6
1881, . .	17·9	1885, . .	15·0
1882, . .	21·6	1886, . .	18·6
1883, . .	26·3	1887, . .	13·5

The high death-rate of 1883 was entirely due to an epidemy of smallpox.

Pathology.—*Malaria.*—The number of persons who died of fever during the ten years ending 1889 was 107, or an average of 9 per annum. Taking the mean population of the same years at 15,000 in round numbers, this would give an annual fever death-rate of 0·60 per 1000, and a ratio of 38·31 per 1000 of the total deaths. The nature of the fever is not specified in the returns. As intermittent fever is unknown in the native pathology, and as only one case of remittent is registered in ten years, we must assume that the fever in Seychelles is of a continued type, not caused by malaria in the ordinary acceptance of this term. The absence of the ordinary forms of malarial fever is attested by all the medical men who have practised in these islands. We notice, as confirmatory of this, that no death from disease of the spleen has been registered during these eleven years, that anæmia has caused on an average only 3·73 deaths, and general dropsy, 1·4 death per annum. We can only conjecture that the Seychelles fever is of the nature of typhoid fever.

Diphtheria is not endemic or epidemic in these islands, as only two deaths are ascribed to this disease during the eleven years ending 1889. These were probably cases of non-diphtheritic laryngitis.

Dysentery takes the lead among the causes of death. During the eleven years with which we are dealing, 583 deaths, out of a total mortality of 3061, or a proportion of 190·46 per 1000, were due to dysentery. Assuming the mean population of the Colony during this period to have been 15,000, the deaths from this cause were in the ratio of 3·53 per 1000 living. *Diarrhœa* gave rise during the eleven years to 66 deaths, so that the combined mortality from the two diseases occasioned 212·02 per 1000 of the total deaths, or a death-rate of close upon 4·0 per 1000 living. Seychelles furnishes a striking example of a non-malarious country, in which dysentery is very prevalent.

Smallpox is not endemic in the Colony, but when introduced, as it was in 1883, it causes a high mortality. *Measles* appears only at long intervals. An epidemy occurred in 1889, which caused 43 deaths—a ratio of 2·6 per 1000 of the population. *Scarlet Fever* is unknown in the Seychelles group. *Whooping-Cough* is of rather frequent occurrence, and causes a high mortality.

Phthisis, next to dysentery, is the most fatal disease in this group. No fewer than 343 deaths were registered from this malady in the eleven years 1879–89, or a ratio of 112 per 1000 of the deaths from all causes, or a little over 2·0 per 1000 living,—a high mortality considering the absence of large towns and unhealthy occupations. *Bronchitis* and *Catarrh* caused 67 deaths in the eleven years, which gives a ratio of 21·88 per 1000 of the total mortality, or a death-rate of about 0·41 per 1000 living. This shows how rare bronchial affections are in the Colony. To *Pneumonia* 32 deaths were ascribed in eleven years—a proportion of 10·45 per 1000 of the total deaths. On an average, only one death a year is caused by *Pleurisy.* We must conclude, therefore, that acute respiratory diseases are exceedingly rare in Seychelles.

Diseases of the Liver, mostly registered as jaundice, give rise to 21·56 per 1000 of the total mortality, or a ratio of about 0·4 per 1000 living. This indicates a comparatively high prevalence of hepatic diseases, other than cirrhosis. *Hepatic Abscess,* however, appears to be of rare occurrence, notwithstanding the great prevalence of dysentery. *Tabes Mesenterica* is a fatal disease of childhood in these islands, causing 30·05 per 1000 of the total deaths, or a ratio of about 0·56 per 1000 living,—a proportion considerably in excess of that which the disease occasions in England. *Leprosy* is by no means rare, seeing that it caused 40 deaths during the eleven years, or about 13 per 1000 of the total mortality. The proportion is perhaps augmented to some extent by persons from Mauritius suffering from the disease. *Rheumatism* is compartively rare. The mortality from this cause is less than 2 per 1000 of the deaths from all diseases. *Syphilis* is said to be common in these islands, but it certainly does not occasion a high mortality. *Scrofula* is rare. Only one death is ascribed to this disease during the whole period under review.

CHAPTER IV.

MAURITIUS.

GEOGRAPHY, TOPOGRAPHY, AND CLIMATOLOGY.

THE island of Mauritius lies in the Indian Ocean between lat. 20° and 20° 30′ S., and between long. 57° 17′ and 57° 46′ E. It is ovoid in form, the smaller end pointing to the north. Its extreme length from north to south is 38 miles, and its greatest breadth 29 miles. Its area is estimated at 708 square miles. The population at the end of 1887 was 368,163, of which 116,821 belonged to the general population, white and coloured, and 251,342 were Indians.

The island is of volcanic origin—dolerite lavas forming the chief mass of the island. Its coasts are fringed by coral reefs throughout the greater part of their extent. These reefs have an average distance of a mile from the shore. A range of hills, sometimes called the Port Louis range, from its running behind that town in one part of its course, starts from near the coast on the north-west and runs in a E.N.E. direction, rather more than half across the island, sending spurs westward towards the sea, which encircle and to some extent also intersect the town of Port Louis. Several spurs are thrown out northwards into the district of Pamplemousses. Its southern aspect rises wall-like towards Moka and Plaines Wilhems. The two prominent peaks of this chain are the well-known landmarks of the Pouce and Pieter Both. This range divides the northern from the central part of the island. The Grand Port chain, sometimes called the Bambou range, begins close to the sea on the south-east coast, runs more than half across the island, terminating near to Curepipe, sending its spurs eastward and southward into the Grand Port district. This range divides the central from the southern part of the island. The Port Louis and Grand Port ranges are connected on the east by a series of hills situated at some distance inland. These are the Motte à Therèse, the Fayence, and the Blanche Mountains, which mark off the central from the coast region on the east. A third chain, consisting of the Tamarin and the Savanne Mountains, skirts the south-west coast and the western corner of the south coast.

Between the northern extremity of this range, constituted by the Trois Mammelles, and Mount Ory (at the south-west extremity of the Port Louis range), and forming as it were a connecting-link between the two, are seen the more or less isolated masses of Corps de Garde, Grand Malabar, and Petit Malabar. This series of isolated hills, again, marks off the central from the coast district on the west, just as the Therèse, Fayence, and Blanche Hills separate it from the coast-line on the east.

The Tamarin and Savanne range support a table-land nearly 2000 feet high, which inclines to the south and south-east, becoming continuous with the plains of Grand Port and Savanne. These have a considerable slope from the interior down to the sea.

We may thus say that the island, as regards its physical configuration, consists of four divisions:—

1. The northern plains of Pamplemousses, Rivière du Rempart, and Flacq, including the coasts to the north-east down to the Grand Port range, and inland to the Therèse, Fayence, and Blanche Hills.

That part of the district lying to the north of the Port Louis chain is, as we have said, penetrated to some extent by the radiating spurs given off by the range. A central spur runs north, in the middle line, as a moderately elevated ridge, forming the watershed between the east and west coasts, and rising into the hills of Mount Piton and the Butte Papaye.

This district is as a whole low, and in many parts flat. The valleys between the spurs of the Port Louis range are close and damp.

2. The central part consists of the open, elevated, and well-drained plains of Moka and Plaines Wilhems, having an elevation of from 700 to 1900 feet.

3. The high plateau to the east of the Tamarin range, with the plains of Savanne and Grand Port sloping to the south and east.

4. The south-west coast-line between Port Louis and the Morne, comprising Plaine Lauzun, Pailles, Petite Rivière, and the whole of the low land separating Petit Malabar, Grand Malabar, Corps de Garde, and the Black River Mountains from the sea, varying in breadth from three and a half miles in the north to half a mile or less in the south. In some places the land immediately along the coast is level for a considerable distance inland; in others the level belt is narrow, except where it runs inland as valleys between the spurs from the hills.

SOILS.

The principal kinds of soil met with in Mauritius, according to Mr. Horne, the Director of Forests and Gardens, who has favoured me with his observations on the subject, are (1) the brown soil, (2) the red soil, (3) the black clayey soil, (4) the rocky soil, (5) the sandy soil.

The brown variety is most common in Mauritius. It is porous, well-drained, free as a rule from stones, or where these exist they are in the form of boulders. Few springs arise on this soil, and those that do occur are only in low places where it is underlaid by rock or clay. This is regarded as a healthy soil, and the northern part of Pamplemousses and the Rivière du Rempart districts are said to owe their comparative salubrity to their being to a great extent composed of this soil.

The red soil, which owes its colour to iron oxide, occurs either as a mixture of small stones, like coarse gravel mixed with clay, or as the genuine *terre-rouge*, which, when moist, is easily worked into a sticky clay, but crumbles into dust when dry. As a rule, the terre-rouge is more or less mixed with clay, which is often found in beds under it, rendering its lower strata impermeable to moisture, which, in places where the slope is insufficient, is retained below the surface, and is dissipated slowly by evaporation. Its most extensive area lies between the Briquerie and Powder Mills, and along the shore from the Latanier stream to Arsenal, an area corresponding to the southern part of Pamplemousses, a decidedly feverish region.

The black clayey soil is very retentive of moisture, but during prolonged dry weather large cracks appear in it. It is generally shallow —from a few inches to three feet in depth. Springs frequently occur where this soil crops out at the surface of porous soils. This soil is met with in the Vallée des Prêtres, Vallée Pitot, Champ de Mars, Champ de Lort, at the Line Barracks, Cassis, and Plaines Lauzun. In fact, a considerable part of Port Louis is built on it.

In Black River district, this soil is found at Albion, Gros Cailloux, Plaine St. Pierre, Bambous village, Clarence estate, part of Rivière Noire estate, on both sides of the road from the bridge on the southern Rempart River to the post at Black River, and from a little beyond the mouth of Black River through Case Noyal to the sea at Morne Brabant. It is also met with in smaller areas in other places. This is with justice esteemed a febrific soil.

Another soil, if soil it may be called, is the rocky soil. These sheets of rock, in many places bare, or with scrub growing in the cracks by which they are lined, are in other localities covered to a foot or more by loose soil, which is generally fertile. Water penetrates this rock by the cracks everywhere existing in it. No streams rise on it, except where it lies on an impervious bed of clay. This soil forms the Plaines des Roches, in Rivière du

Rempart district, and is also met with in the lower parts of Flacq. It is somewhat extensively met with at Nouvelle Decouverte, Quartier Militaire, and Camp de Masque.

Sandy soil is met with, but not in extensive areas, all along the coast. The largest area of such soil lies between Canonnier's Point and Choisy Sugar Mills. Mixed with disintegrated coral and a certain amount of decayed vegetable matter, and sometimes covered with rotting sea-weed, it is probably not destitute of fertility if it were watered. On a soil of this nature (as the first Fever Inquiry Commission reports) was situated the Rifle Camp at Petite Rivière, and the military post of Black River, at which two stations not a man escaped from the effects of the malarious fever during the epidemy.

RIVERS, FORESTS, MARSHES.

The streams rising in the northern and level districts are the Terre Rouge, Calebasses, and Pamplemousses Rivers—all of small size, and falling into the sea on the north-west coast. The Rivière du Rempart runs into the sea on the north-east coast. The Grand River N.W. rises in the centre of the island, and falls into the sea a little to the south-west of Port Louis. The southern Rivière du Rempart and the Tamarin Rivers arise in the table-land formed by the Black River Mountains, and run into the sea on the south-west coast. Rivière Noire and similar smaller streams, rising in the gorges of the Black River Hills, run a short course to the sea. On the east the most important rivers are the north Rivière du Poste and Grand River S.E., both rising in the high lands of the central portion of the island to the north. The Rivière des Crèoles, the Rivière la Chaux, and the south Rivière du Poste rise to the south of the Grand Port range. Along the coast of Savanne are numerous streams, mostly unimportant as regards size. When the country was generally covered with forest, these streams were much larger than at the present day. Many streams, formerly perennial, are now dry, except during the heavy rains. The volume of all the others has greatly diminished. The Rivière des Calebasses, for example, during the dry season, contains only about one-fourth the volume of water that it did in 1788. During exceptionally heavy rains, many of the rivers are liable to overflow their banks and inundate the surrounding country. Inundations of greater or lesser severity are known to have occurred at various times since the occupation of the island. In this century great floods are recorded as having taken place in 1815, 1830, 1834, 1836, 1844, 1845, and again in 1861, 1865, and 1888.

The island was originally covered throughout its entire extent with forests, which have been gradually disappearing *pari passu* with the spread of cultivation and the increase of the population. In the year 1770 the area in forests was 372,680 arpents, the area of the entire island being 432,480 arpents. In 1846 the forest land was estimated at 136,000 arpents. At the present time the area under wood is not supposed to exceed 35,000 arpents; and but a small portion of this includes the remains of the original forest. Although the destruction of the forest has been going on since the first settlement of the island, it is only during the past twenty or twenty-five years that the interior has been denuded; and it appears reasonable to suppose that the deforesting of the higher lands has effected greater changes in the climate of the Colony than did the more extensive clearings of the littoral in former times.

Although actual marshes, in the ordinary sense of the word, are not numerous or extensive in Mauritius, yet certain marshy conditions are by no means wanting. As regards actual marshes, the most extensive are those in the high lands, which, from their elevation, or from the fact that they are always super-saturated, are not at all febrific. On the low lands we find marshes along the coast of Black River, as at Albion, Wolmar, Bambous, near to Tamarin, and at other points. In South Pamplemousses, marshy areas exist at Beau Plan, near the village of Pamplemousses, and to a small extent along the course of some of the streams. The north part of Pamplemousses is non-marshy, as is also the greater part of Rivière du Rempart, where marshes are only found at Poudre d'Or, and at Ile d'Ambre estate, on the coast, and these are of no great extent. Marshes are more numerous in Flacq district. Near the centre of Flacq there is a tract of marshy land nearly 100 acres in extent. Constance, La Gaieté, Choisy, Bras d'Eau, and Belle Rose, are some of the other marshy localities in this district. Along the coasts of Grand Port and Savanne districts we also meet here and there with marshy areas. The entire extent of marshy land in the Colony has never been ascertained by survey, but I should not estimate it as above 4000 acres. In addition to marshes, there exist some considerable ponds, natural or artificial, the banks of which are sub-marshy.

Several tidal inlets or "barachois," leaving mud exposed at low water, are met with along the coast. Of lagoons proper I know of only one at Flic en Flacq, and another at Albion, both on the west coast, to which we may add the Mer Rouge, in the harbour of Port Louis. At Belle Mare, on the east coast, there is a salt lake close to the sea; and at Palma, on the same coast, there are salt ponds, more or less brackish. Salt water fish ponds, generally formed in natural creeks, are rather numerous all along the coast, and, when partially dried, these may be regarded as salt marshes. A considerable extent of irrigated ground is met with in Black River, Rivière du Rempart, and Flacq districts, especially near the coasts. The combined area of all those marshes, lagoons, and barachois, which may be supposed to be febrific, although considerable, is small compared to the extent of low and level ground, with a more or less impervious subsoil, in which water stagnates for a time after the heavy rains, and slowly disappears by evaporation. Such soils are, in fact, potential marshes, and may perhaps be more insalubrious than ordinary swamps.

The marshes, tidal inlets, and lagoons now existing have always existed. Nor are inundations, as we have seen, to be regarded as recent phenomena in the meteorology of the island; yet it may be reasonably conjectured that the marshes, though now of smaller extent, differ in character from what they were when the low country was better watered, and the humidity was more constant; and it is not difficult to believe that, now that the country is almost denuded of forest, inundations may be more frequent, more severe, and even more injurious to health than they were formerly under different conditions.

CLIMATOLOGY.—The principal features in the meteorology of Mauritius will be gathered from the following table:—

	Monthly Atmospheric Pressure. Sea-level.	Monthly Rainfall at 8 Stations.*	Monthly Mean Rainfall at Observatory.	Relative Humidity. Observatory.	Monthly Mean Temperature. Observatory, 179 ft.	Monthly Mean Temperature. Beau Sejour, 970 ft., Plaines Wilhems.	Mean Rainfall at other Stations in Grand Port.	
	1875–86	1871–86	1875–86	1875–86	1875–86		1871–79	Soil Temperature.
January, .	29·951	10·32	6·30	74·7	78·7	76·4	12·88	
February, .	29·937	8·24	5·88	75·5	78·6	76·5	9·13	1885—5 ft. 0 in.
March, .	29·979	10·40	6·40	76·2	77·9	75·8	14·28	Highest (March), . . 81·6
April, .	30·009	8·35	5·87	76·4	76·6	74·4	12·79	Lowest (Sept.), . . . 75·0
May, . .	30·088	5·86	5·12	74·5	72·9	71·0	7·27	Mean, ... 78·0
June, .	30·176	4·13	1·98	72·3	70·2	68·1	6·84	
July, .	30·208	3·79	2·24	72·4	68·8	66·7	4·93	
August, .	30·203	3·35	1·87	72·1	69·0	67·1	6·18	
September,	30·198	2·51	1·56	71·4	70·0	67·9	3·68	1886—5 ft. 2 in.
October, .	30·143	2·53	1·85	70·8	71·7	70·1	3·90	Highest (March 17–28), 81·6
November,	30·073	2·78	2·10	70·9	74·7	72·1	5·02	Lowest (Aug. 23–30), . 75·3
December,	30·007	6·57	5·41	73·9	77·5	75·4	9·24	Mean, ... 78·6
	30·081	68·83	46·58	73·4	73·9	71·8	96·15	

* 1. Labourdonnais, . . .	290 feet.	5. Gros Bois, ...	500 feet.
2. Observatory, ...	179 ,,	6. Beau Vallon, ...	60 ,,
3. Botanical Gardens, Pamplemousses, ...	225 ,,	7. St. Aubin, ...	300 ,,
4. Beau Sejour, ...	970 ,,	8. L'Union, ...	90 ,,

PORT LOUIS AND OTHER TOWNS.

The town of Port Louis is situated on the north-west coast, at the foot of the range of hills already mentioned, the Pouce Peak lying about two miles south-east of the town. Several parallel streams run through the town in valleys separated from each other by gentle ridges. Thus we find the Crèoles stream running along a depression at the foot of the Signal Mountain. Another parallel depression gives passage to the Pouce and La Butte à Tonier streams; further to the north-east a third depression is met with, through which flows the Pucelles stream, and through a fourth parallel valley flows the Fanfaron stream; while beyond this again is the Latanier stream. All these streams run through the town to find their way directly or indirectly into the harbour, and are separated from each other by the four parallel ridges upon which the town is built. The site of Port Louis, consisting of a succession of moderately raised and gently sloping parallel ridges, is thus naturally favourable to drainage.

The town has a population of about 60,000. The houses in many parts are poorly built, insufficiently elevated above the ground, and overcrowded. The dry-earth system of night-soil service is that used in the town; cesspits are prohibited. The scavengering is well performed. Few towns in the East will compare, at least in outward cleanliness, with Port Louis.

The sewage, waste water, and rainfall are carried off in open gutters. If these were well constructed, and kept clean, no better system could be devised. There exist a few underground drains in masonry—badly constructed, but these are of no great length, and they cannot be too soon abolished or replaced by properly constructed sewers.

The greatest defects in the sanitary arrangements of Port Louis are, the total absence of subsoil drainage to remove humidity from the soil; the neglect of levels, which leads to the stagnation of water underneath houses; the natural or artificial obstructions to the drainage which exist in many localities; the imperfect paving of yards, so that percolation of waste and rain water and of sewage freely takes place into the soil; the defective construction of the gutters; and finally, the bad construction and overcrowding of houses. In many cases the soil upon which houses or whole streets are built is water-logged during the rainy season.

Much money has been expended on sanitary works in Mauritius during recent years, with little or no reduction in the rate of mortality, but nothing effectual has been done to remedy the evils mentioned above, which appear to me to be of great importance with reference to the causation of malaria.

The most important town next to Port Louis is Curepipe, situated in the district of Plaines Wilhems, at a height of from 1800 to 1900 feet above sea-level, near the centre of the island. The population is about 8500. Here are the villas of a considerable portion of the well-to-do classes, who go down to Port Louis for business in the morning, returning to Curepipe in the evening. From its elevation above the sea-level, and its position between the east and west coasts, Curepipe has a climate at once temperate and humid. The annual mean temperature here is 66°·3 F., or 10° lower than that of Port Louis. The annual rainfall is from 100 to 160 inches.

Rose Hill, at an elevation of 923 feet, and Beau Bassin (with which it is almost continuous), at 727 feet, are both in the district of Plaines Wilhems. The former has more the character of a town than the latter, although both consist to a great extent of detached houses, with gardens scattered over a considerable extent of country. The town of Mahebourg, in the district of Grand Port, on the south-east coast, has a population of about 4000.

One of the remarkable features in regard to the distribution of the inhabitants, is the number of Indian camps scattered over the Colony. Those which are occupied by the labourers on the sugar estates are under sanitary supervision; but the numerous camps occupied by Indians not under engagement, present a state of things, from a sanitary point of view, that leaves much to be desired. These camps consist of thatched houses, often overcrowded, deficient in light and air, generally huddled together without order, and in close proximity to cow-houses and swine-pens. Fowls and goats are often kept, contrary to law, in the huts occupied by the Indians.

The birth-rate of the Colony (1881–85) was 36·27, and the death-rate, 32·46 per 1000. As many of the marriages are contracted according to Hindoo customs, which are not recognised by the law of the Colony, to give the marriage-rate would be misleading.

CHAPTER V.

MAURITIUS.

PATHOLOGY, PRE-MALARIAL PERIOD.

We shall now cast a brief glance at the pathological history of the Colony prior to the outbreak of fever in 1866. Dr. Chapotin,[1] in the beginning of the century, mentions that he had noticed one or two cases of fever, following the tertian type, but he states that they did not maintain that type, but soon became converted into the continued form with exacerbations. He does not say whether the patients were or were not natives of the island. Carosin[2] appears also to have seen some few cases of remittent and intermittent fevers in Mauritius before 1837. These affections were extremely rare. The extreme rarity of intermittent fever in Mauritius is proved by the records of the Civil Hospital. From an official return of the admissions into that institution, I find that during the forty-five years 1820–65, only twelve natives of the Colony were admitted into the hospital for intermittent fever, and it cannot be known whether these persons may not have contracted the disease elsewhere. Many of the medical officers in charge of the military remark on the absence of paroxysmal fevers in Mauritius. Thus, Dr. M'Mullin, in 1828, says that "no intermittent fever has been seen in Mauritius." In 1831, Dr. Collier reports that "fever of the intermittent type, whatever may be the reason, is very rare." Dr. Stewart, in 1834, states that "malarious fevers originating in other countries generally recover favourably in Mauritius." In 1851, Dr. Thom refers to the great quantity of decaying vegetable matter, moist land, and other possible sources of malaria, and observes, "Yet with all these circumstances so very favourable to miasmata, it is a notorious and remarkable fact, that intermittent and remittent fevers are unknown; the only instances in which they have occurred clearly proved them to have been imported from Europe or Asia." In 1855, Dr. Clerihew notes that "as usual the island has been free from all kinds of periodical fever, only one case of intermittent appearing in the returns, and none of remittent." The case of intermittent fever referred to occurred in the 85th Regiment from England. The same medical officer points out, in 1860, that the 31 cases of intermittent fever, occurring among the troops in that year, were in men of the 61st Regiment, who had suffered from malaria in India. We have thus concurrent and continuous testimony as to the entire, or almost entire, absence of intermittent and remittent fevers from the pathology of Mauritius from the year 1812 to 1860, the eve, as it were, of the epidemy which began in 1866. These statements are fully borne out by statistics. From 1823 to 1858, out of a strength varying, as a rule, from 1145 to 2321, there were 51 admissions into the military hospital for intermittent fever, which gives an average of less than two cases per annum. During these thirty-five years only one death occurred from intermittent fever. During the same period there were only ten cases of remittent fever, with no deaths. It is doubtful whether during this period a single soldier was admitted for paroxysmal fever contracted on the island.

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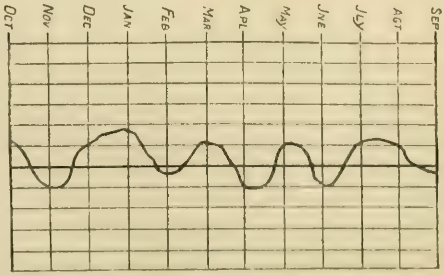
[1] *Topog. méd. de l'île de France*, Paris 1812.

[2] *Observation sur quelques maladies de l'ile Maurice*, Maurice 1837.

During the seven years 1859–65, the cases of intermittent and remittent fever, however, became more numerous. No fewer than 153 cases of intermittent fever and four deaths occurred in those years, while the cases of remittent during the same period were 21, with four deaths. It was in the 61st Regiment, which arrived from India in July 1859, after sixteen years' service there, that intermittent fever was most common. After eight months' stay in the Colony, it is noted that the fever had steadily and progressively diminished all that time. In 1862, the Royal Artillery, from China, arrived in the Colony, saturated with malaria. Not one of the cases of fever mentioned above occurred in persons who had not already contracted the disease elsewhere; but it must be remarked that, whereas troops arriving from India and other malarious places up to 1858 rarely suffered from relapses, after reaching the Colony, these relapses became rather numerous and more fatal after this date. It is possible that the troops arriving in the Colony during the seven years in question may have been more thoroughly saturated with malaria than those arriving at any corresponding period during the previous thirty-five years. Still, it strikes us as indicative of some change in the health of the Colony, that the admissions per annum from malarial fever during the first period were at the rate of 1·46 per annum, while in the second they were 21·86. But if such a change was in progress during these years, it did not manifest itself in the admissions to the Civil Hospital. The admissions for intermittent fever in the seven years ending 1858 were 141, and for remittent fever 18; whereas, for the seven years ending 1865, the admissions were 100 for the former type and 50 for the latter. The total admissions for these two forms was thus actually less during the latter period, although a considerable increase in the graver form is manifest. As regards the military, it is pretty certain that no case of paroxysmal fever contracted in the island had been observed up to 1865. Respecting the fever admissions into the Civil Hospital of natives of the island (twelve in all) during forty-five years, it is uncertain how many of these occurred in persons who had been in Madagascar or in other malarious countries. Dr. Beaugeard, the surgeon to the hospital, states that "cases of ague have been admitted occurring in persons who had long been resident in the Colony, and in others who had never left the island at all—these latter, however few, still existed prior to 1865." This would make it appear that the cause of paroxysmal fever existed in the island prior to 1865, but how long before it is impossible to say. The statements of some medical men to the Fever Inquiry Commission imply, more or less distinctly, that they had observed a few cases of paroxysmal fever in persons who had never left the Colony, perhaps as far back as 1859, in the districts of Pamplemousses and Rivière du Rempart, and in 1857 in the district of Flacq. However this may be, it may be safely said that up to 1865 such cases were extremely rare, and we are bound to conclude that Mauritius, up to 1865, practically presented a *tabula rasa* as respects malaria, at least in its ordinary manifestations. That some new element made its appearance in the pathology of Mauritius about this time, will be evident from the complete change that has taken place in the monthly mortality since 1866. This has been well shown by Dr. Meldrum, whose diagrams I reproduce.

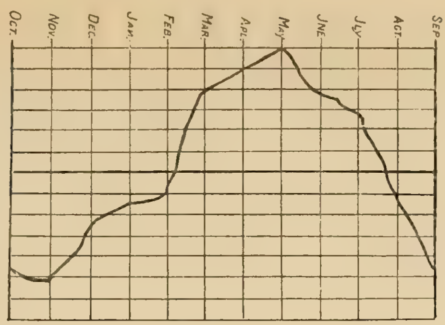
The diagrams show the present mortality curve as compared with that before the fever epidemy, and the influence of fever and dysentery upon the monthly distribution of the total deaths (Meldrum).



No. 1.
Total Mortality in 1861–66.
Scale:
1 div. = 32·5 deaths.

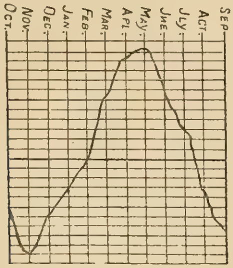
954·2 deaths.

No. 2.
Total Mortality
at the present day.
Scale:
1 div. = 27·2 deaths.



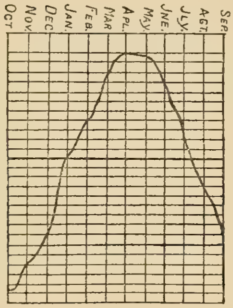
811·8 deaths.

No. 3.
Fever Mortality
at the present day.
Scale:
1 div. = 13·2 deaths.



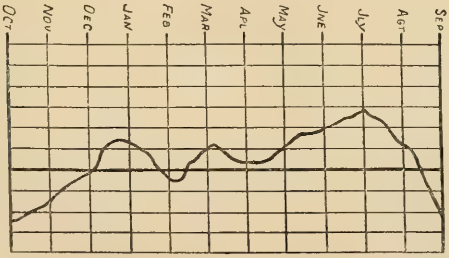
396·5 deaths.

No. 4.
Dysentery Mortality
at the present day.
Scale:
1 div. = 2·4 deaths.



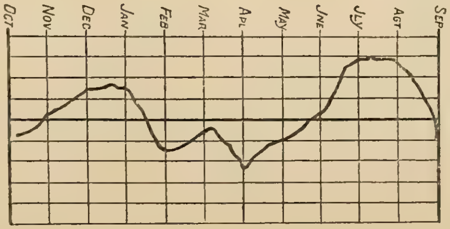
72·2 deaths.

No. 5.
Total Mortality,
minus Fever Deaths.
Scale:
1 div. = 13·7 deaths.



415·3 deaths.

No. 6.
Total Mortality,
minus Fever and
Dysentery Deaths.
Scale:
1 div. = 11·4 deaths.



343·1 deaths.

A glance at the above diagrams will show the extent and the nature of the change that has taken place in the health of the Colony since 1866. It will be seen from diagram No. 1, that before the fever epidemy the mortality oscillated slightly above or below the mean, this oscillation being repeated several times during the year. The curve did not differ very materially from that of the mortality at the present day, when the fever deaths are eliminated, see diagram No. 4. Diagram No. 2 shows the effect of the malarious element in throwing the mortality, as it were, into one period, that is, from March to July, so that the curve becomes not an oscillating one, but a single and shorter sweep of great amplitude above, and another of longer duration but less amplitude below, the mean. It is needless to say that, in order so completely to alter the distribution of deaths as these diagrams indicate, the change in the medical constitution must have been one that very deeply affected the health of the population.

Having now shown that paroxysmal fevers were almost unknown before 1866, and that since that period a new element has made itself felt so as to change the annual evolution of mortality, let us see what were the climatic diseases of the island before the change we have alluded to took place.

The following table, prepared from the statistics published by my late lamented friend, Dr. Reid, gives the admissions and deaths per 1000 among the troops from 1823 to the middle of 1867 for various forms of fever and dysentery:—

Period.	Continued Fever.		Intermittent Fever.		Remittent Fever.		Typhoid (Enteric) Fever.		Typhus Fever (after Cholera).		Dysentery.	
	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.
1823	86·9	0·80	1·60	...	...	...	...	...	...	...	89·3	5·62
1824	117·0	0·83	1·66	...	...	...	...	...	...	...	129·5	8·35
1825	218·3	...	2·62	0·87	...	...	...	...	...	...	131·9	4·36
1826	126·1	2·91	2·18	...	...	...	...	...	...	...	326·0	6·56
1827	140·7	0·50	...	...	...	...	...	...	...	...	192·8	4·29
1828	175·2	6·94	...	...	...	...	...	...	...	...	314·6	17·35
1829	84·7	1·12	0·56	...	...	...	...	...	...	...	201·1	11·08
1830	118·2	2·88	...	...	1·72	...	...	...	...	...	140·8	5·19
1831	226·1	...	...	...	...	...	...	...	...	...	188·8	15·46
1832	244·9	1·51	...	...	...	...	...	...	...	...	208·1	11·08
1833	222·7	2·58	...	...	...	...	...	...	...	...	227·0	8·61
1834	191·6	2·59	...	...	...	...	...	...	...	...	203·7	0·99
1835	175·8	...	...	...	...	...	...	...	...	...	154·3	12·48
Jan. 1836 to Mar. 1837	175·2	2·41	...	...	...	...	...	...	...	...	166·1	13·89
1st April 1837 to 31st Mar. 1838	159·1	2·44	1·22	...	...	...	...	...	...	...	182·3	9·79
1838–1839	119·5	3·14	0·62	...	...	...	2·51	1·88	...	...	164·8	20·13
1839–1840	107·1	...	...	...	...	...	...	...	...	...	71·4	9·74

Period.	Continued Fever.		Intermittent Fever.		Remittent Fever.		Typhoid (Enteric) Fever.		Typhus Fever (after Cholera).		Dysentery.	
	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.	Admission-rate per 1000.	Death-rate per 1000.
1st April 1840 to 31st Mar. 1841	107·0	1·52	0·50	...	...	...	1·01	1·01	...	...	62·9	4·56
1841–1842	104·2	1·54	...	...	...	...	1·54	1·54	...	...	56·9	6·67
1842–1843	95·9	0·52	1·56	...	...	...	...	...	...	...	57·3	9·30
1843–1844	147·9	1·06	1·06	...	...	...	0·53	0·53	...	...	84·6	11·18
1844–1845	235·7	4·51	...	...	...	...	...	...	...	...	72·7	3·94
1845–1846	244·1	2·28	...	...	...	...	1·71	1·14	...	...	63·4	6·86
1846–1847	118·4	1·13	2·80	...	3·3	...	1·13	1·13	...	...	73·5	5·61
1847–1848	78·4	...	0·56	...	...	...	5·60	2·24	...	...	103·6	4·48
1848–1849	91·9	2·61	...	...	...	...	4·17	3·13	...	...	87·7	2·61
1849–1850	97·2	0·50	3·02	...	0·5	...	1·51	1·51	...	...	76·0	10·07
1850–1851	79·6	1·07	0·51	...	...	...	0·51	0·51	...	...	54·3	3·22
1851–1852	148·2	...	4·21	...	...	...	0·70	0·70	...	...	77·3	8·43
1852–1853	98·3	...	...	...	...	...	2·68	2·68	...	...	5·0	5·36
1853–1854	46·5	...	1·12	...	...	...	16·81	3·92	...	...	53·2	3·36
1854–1855	99·1	...	...	...	...	...	5·93	3·56	...	...	83·6	11·27
1855–1856	88·3	1·11	0·56	...	...	...	5·03	1·67	...	...	50·8	2·79
1856–1857	120·7	0·83	5·02	...	...	...	...	...	2·51	1·67	37·7	1·67
1857–1858	193·4	1·36	4·08	...	...	...	1·36	1·36	...	...	68·1	2·72
1858–1859	137·0	1·31	22·39	...	...	...	2·63	2·63	...	...	80·3	3·95
1st April to 31st Dec. 1859	30·7	...	31·89	...	...	...	0·59	0·59	...	...	47·8	0·59
1860	124·0	1·59	16·43	0·53	4·7	1·06	15·90	2·12	...	...	99·6	6·36
1861	20·8	0·52	1·04	...	2·0	...	0·52	0·52	...	...	79·8	2·08
1862	45·8	0·48	19·03	0·48	2·9	0·97	...	...	1·95	0·97	35·6	2·92
1863	44·9	1·01	2·52	0·50	...	...	...	...	...	...	48·5	2·02
1864	35·7	0·55	1·65	0·55	...	...	...	...	...	...	45·8	1·11
1865	72·2	...	1·06	...	1·0	...	2·65	1·06	...	...	6·7	15·94
1866	79·7	0·56	11·22	...	10·1	0·56	2·24	1·68	...	...	60·6	1·68
1867	154·0	0·75	380·66	0·75	1106·4	15·86	6·79	3·02	...	...	89·8	8·30
1st Jan. to 30th June 1868	4·0	0·66	180·66	2·00	1062·6	8·00	...	...	...	...	34·6	2·00

The first thing that strikes one in looking at this table is the comparatively small ratio of fever admissions and deaths. In fact, the average fever admission-rate for the forty years included between 1823 and 1862 was 134·9 per 1000, and the fever death-rate, 2·45 per 1000. The admission-rate for paroxysmal and continued fevers for the nine years 1877–85 (that is, after the epidemy) was 1279·1 per 1000, and the fever death-rate, 5·72. This again indicates the great change that has come over the Colony since the outbreak of malaria; and the difference between the two periods, as regards admissions and deaths, would appear still greater were the period of service in the Colony as prolonged as it formerly was.

It will be seen that typhoid fever is first noticed in 1838–39, and from that time onwards it is seldom absent from the returns. It is highly probable that the disease existed before that date, but was not recognised, being regarded as, and returned under the heading of, continued fever. But apart from typhoid fever, a species of continued fever prevailed every year in the Colony, and sometimes assumed an epidemic form, but was never very fatal. In the decade 1843 to 1852, that is, a decade when typhoid fever was recognised as a distinct disease, this continued fever gave rise on an average to one death in 100 admissions. This fever was epidemic, both among the troops and the civil population, in the years 1844, 1845, and 1846. In this epidemy, the attack, we are told, was generally ushered in with chilliness, debility, and loss of appetite, succeeded by rigors, headache, pains of the back and limbs; the skin was hot, and the pulse accelerated. For about forty-eight hours the symptoms continued severe, then subsided, and in the majority of the cases convalescence began the sixth, seventh, or eighth day. In *all* the fatal cases there was seen to be congestion of the brain, and in *some* of them there was an unusual vascularity of the coats of the stomach and large intestines, especially of the cæcum. The deaths from this fever among the troops took place on the fifth, sixth, and seventh days. This epidemy was more common in Port Louis than at the other stations occupied by the troops, and was ascribed to the high and sudden changes of temperature, and to the moist state of the atmosphere. It fell with greater severity on a range of the barracks near to which ran a filthy town drain. In only one case was a relapse observed. There can be little doubt, from the localities and circumstances in which this disease occurred, that it was due to some miasmatic influence, although it was clearly not malarial.

It will be seen that dysentery in the pre-malarial period was far from uncommon, and in some seasons caused a considerable mortality, another proof—if proof were needed—that dysentery is not necessarily associated with malaria. Dysentery and hepatic abscess are known, from the accounts of a Huguenot prisoner, to have been endemic in the island in the seventeenth century.

Another form of fever has still to be mentioned, which was frequently met with before 1866, and which does not appear in the military returns, as it was almost entirely confined to the Indian population. This fever was known in the Colony as Bombay fever, or as bilious typhoid, and its nature has given rise to much discussion. It appears now to have entirely disappeared, at least it has ceased to be recognised in the return of deaths. It is said to have first made its appearance coincidentally with typhoid fever —or rather about the time when typhoid fever was distinguished from the continued fever then prevalent, viz. about the year 1838.

The distinguishing characters of Bombay fever were its contagiousness, its almost exclusive incidence upon one section of the population, and its appearance as localised epidemies in individual sugar-estate camps, on the coast and central regions indifferently. There were a few instances in which Europeans and Creoles were attacked, but it is remarked that such instances occurred in persons, such as hospital attendants, who were brought into close contact with the patients.

The disease appears to have been of a continued rather than of remittent type; it did not induce cachexia, nor was it followed by attacks of paroxysmal fever; and, as we have said, it prevailed in non-malarious districts.

The disease had usually a period of from ten to fourteen days, or, according to some, of twenty-one days or more. All the writers who saw much of the disease speak of deaths taking place sometimes within twelve to forty-eight hours of its outset. In long-continued cases, the disease developed that group of symptoms known as typhoid. Jaundice was a frequent, but not a constant symptom, and usually manifested itself about the fourth or fifth day. Relapses were not uncommon, and are stated, by more than one who had opportunities of seeing much of the disease, to have been commonly fatal. These relapses were, rightly or wrongly, ascribed to errors of diet. Convalescence is said to have been prolonged. Intestinal hæmorrhage is mentioned as not unfrequent; and we read of diarrhœa, parotitis, and orchitis as sequelæ of the disease.

After death there was always found enlargement of the liver,—the gall-bladder containing bile of the normal colour, but sometimes thick and oily. Other lesions were met with, although not in all cases. Cerebral congestion was noticed in cases terminating in coma, also in those that died within the second or third day of the disease. Such, according to Beaugeard, were the lesions most frequently noted in 135 autopsies made at the Civil Hospital. Several medical men found ulceration of Peyer's patches. Perforation of the bowels is also noticed by some as a cause of death. Beaugeard, however, met with none of these lesions in the autopsies made by him.

In the years 1862–63 the deaths from bilious typhoid were in the ratio of 376·1 per 1000 of admissions. Quinine is stated not to have had any influence upon the malady. We are thus compelled to conclude that two distinct diseases were included under the name of Bombay fever. The descriptions of Bombay fever that have come down to us present an imperfect and confused picture, but I think I can distinguish in it the outlines of two distinct fevers, one undoubtedly true typhoid, as is proved by the characteristic lesions of that disease, the other probably essentially similar to the bilious typhoid of Griesinger. It is well known that numerous cases of true typhoid are often observed as co-existing with epidemics of bilious typhoid. Hence the confusion that has arisen respecting the nature of Bombay fever.

Cholera has been epidemic five times in the history of Mauritius, viz. in 1819, 1854, 1856, 1859, and 1862.

CHAPTER VI.

MAURITIUS.

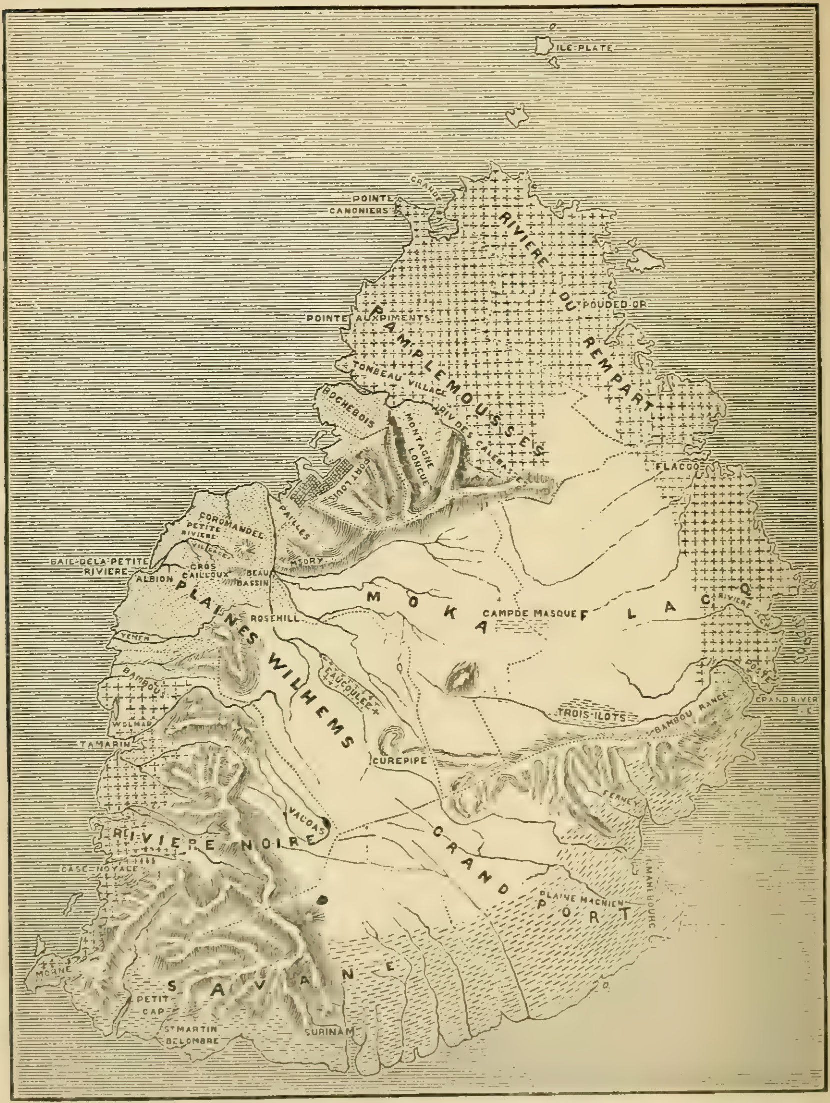
FEVER EPIDEMY OF 1866–68.

Sporadic cases of malarial fever contracted in the island were observed from the beginning of 1865, and throughout the year. They were few in number, and seem to have been chiefly confined to the marshy localities near the mouth of Grand River, or to the unhealthy spots near the shore in Port Louis. A slight local epidemy occurred towards the end of the year 1865 among the Indian labourers on Wolmar estate, a specially marshy locality on the sea-coast in Black River district. A considerable number of cases were also observed in November on Albion estate, and near the church at Petite Rivière, at the latter place from the 15th to the 25th November.

These sporadic cases and slight localised epidemies attracted little notice at the time, and gave rise to no apprehension of the coming visitation. In 1866, the fever assumed a distinctly epidemic character. It first broke out at Albion estate, on the sea-shore of Petite Rivière, and at Gros Cailloux in the same neighbourhood, but a mile and a quarter inland. The following table gives the number of cases of fever and of deaths on these two estates during the year 1866:—

	Albion.		Gros Cailloux.	
	Cases.	Deaths.	Cases.	Deaths.
January, ...	2	0	1	1
February, ...	12	4	14	1
March, ...	35	2	176	1
April, ...	24	2	83	1
May, ...	41	1	81	8
June, ...	18	13	33	8
July, ...	14	4	32	12
August, ...	8	2	24	5
September, ...	1	0	15	0
October, ...	9	0	31	0
November, ...	6	2	15	2
December, ...	37	1	12	2
Total, ...	207	31	517	41

Map of Mauritius, showing the Districts successively invaded by Malarial Fever during the three years 1866, 1867, and 1868.



The dotted shading represents the districts affected in 1866; the cross shading those attacked in 1867; and the interrupted lines those reached in 1868.

Some time in November or December 1865, or in January 1866, —for accounts differ as to the date,—the barachois at Albion was cleaned, and the mud, heaped up on the banks, was exposed to the action of the sun's rays, and after a time was carted away as manure to the cane fields. Whatever may have been the exact date, it is certain that at the beginning of 1886, the extremely fœtid odour exhaled by this mud gave rise to a nuisance, which attracted attention and complaint. It has been held by some that this was the exciting cause of the outbreak on Albion estate, and it may be conceded that it was likely to intensify the disease in that locality; but from what we have already seen, there had been an altogether unusual number of cases of fever in the sub-district of Petite Rivière, where Albion is situated, before the barachois was cleaned out.

Whichever of the dates mentioned above may be the true one, there were other local conditions, besides the cleaning out of the barachois, that may have led to the appearance of the fever in this district. Albion is itself marshy, the soil is of black clay, and a lagoon, although of no great extent, exists on the shore. Gros Cailloux, which, it will be seen, was affected almost simultaneously with Albion, is not marshy, but there are several springs on the estate, as well as a large pond for irrigation purposes, and from these causes a considerable area of soil was rendered humid.

While the epidemy was making its way at Albion and Gros Cailloux, it was gradually extending northwards and southwards. Taking its northern extension first, we find the disease to have been common, but not severe, at Grand River N.W., which is about three miles north of Gros Cailloux, in February. The Lunatic Asylum, then situated at Grand River, but at some distance up from its mouth, was not affected until May, when five cases of intermittent fever occurred among the inmates. In June, eleven cases occurred, with four deaths, in the same institution. Still further north, at Port Louis and its neighbourhood, a few cases had been observed by Drs. Barraut, Penaud, and Beaugeard in January and February 1866. The patients seem to have inhabited the marshy suburbs of the town, especially the Cassis district. The cases in these localities and other unhealthy parts of the town and its suburbs increased very much during the succeeding months of March, April, May, June, and July; they then decreased as the year advanced, to augment again in November and December. Sporadic cases were noticed as far north as Arsenal, Pointe aux Piments, and the Pamplemousses district, in April and May, and later on at the village of Pamplemousses itself, and at Tombeau;

but I do not gather that the disease was epidemic in any of these places at this date. It would appear, however, that close to Calebasses River a rather considerable number of cases occurred in May and June.

Such was the northern march of the disease during this season. To the south of Albion and Gros Cailloux the epidemy extended to the village of Bambous, another marshy locality three miles to the south of Albion, where its progress was temporarily arrested. Here again sporadic cases were noticed in the district beyond the epidemic area, for in August cases were observed on Rivière Noire estate to the south of Bambous. It is possible that these may have been contracted by persons visiting the district where the epidemy was prevalent. It will be seen that the first wave of the epidemy extended northwards along the coast from Albion to Rivière des Calebasses, a distance of 10½ miles, and southwards to Bambous, a distance of three miles, occupying in all a strip of the sea-coast about 13½ miles in length, and extending on an average from two to four miles inland.

The following were the monthly admissions and deaths in the Civil Hospital from the three forms of fever in 1866:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
ADMISSIONS—												
Intermittent, . .	2	3	9	13	28	53	50	27	18	29	35	72
Remittent, . .	12	11	5	8	22	12	11	4	8	16	11	29
Pseudo-continued, .	45	35	44	55	60	57	39	47	50	40	78	61
Total, . .	59	49	58	76	110	122	100	78	76	85	124	162
DEATHS—												
Intermittent, . .	..	..	1	..	3	4	4	5	2	1	4	6
Remittent, . .	8	7	2	2	1	..	6	2	3	7	6	14
Pseudo-continued, .	..	..	..	..	8	7	..	..	..	..	..	..
Total, . .	8	7	3	2	12	11	10	7	5	8	10	20

If we consider the absence of deaths during the first four months from the pseudo-continued fever, its malarial character at the beginning of the year is doubtful. It will be seen, by comparing the admissions in Port Louis with those at Albion and Gros Cailloux, that the epidemy at Port Louis attained its maximum in May and June, while at the two latter localities it had begun seriously in February, and had attained at Gros Cailloux its maximum prevalence in March. It is clear that the disease, as an epidemy, was about two months later in showing itself at Port Louis, seven miles north of Albion. It may thus be roughly estimated that the epidemy marched at the rate of about 3½ miles a month. As in the Civil Hospital 103 deaths occurred in 1099 admissions, the death-rate was about 10 per cent. (9·36) on the admissions; and, taking the combined returns of Albion and Gros Cailloux, the mortality was practically in the same ratio. The disease in 1866 was thus of a malignant type.

It is recorded that at Gros Cailloux more persons died of the resulting dysentery, dropsy, and debility, than from the fever itself. So that the figures given above do not adequately represent the fatality of the epidemy. One other point of interest is to be noted. At Gros Cailloux, several of the Indians and their families were seized with a kind of influenza and fever about the 10th of February—that is, immediately before the outbreak of fever. A kind of influenza was also the precursor of the epidemy in Grand Port two years later, and was very prevalent a few years ago on the estates in the south-west part of the island, either before or after an outbreak of fever, but I am not sure which.

The second wave began to manifest itself in November 1866. This will be seen by the table of admissions into the Civil Hospital already given. The districts affected, in the earlier part of 1866, were all again attacked. But the disease did not restrict itself to these; during the two last months of 1866, and the first seven months of 1867, it invaded the whole of the west coast from south to north, passed round the northern extremity of the island, and extended down the east coast as far as Grand River S.E. It did not reach quite to the south coast of the island, but was arrested at the Morne, where the mountains, running down to the sea, form a barrier between the coasts of Black River and Savanne. In the same way it did not this season enter the Grand Port district, but became arrested at Grand River S.E., where the Grand Port range throw down their spurs close to the water's edge. Did these physical barriers, in some way, serve to arrest the onward progress of the fever in 1867? I think they did. There is no other apparent explanation why the disease should have stopped at these particular spots in that season, for it had already reached both the Morne and Grand River S.E. before the setting in of the cold weather, which might have been looked upon as the cause of its arrest. Both in Black River, Port Louis, and Pamplemousses, the wave began to rise very distinctly in January 1867; it invaded Rivière du Rempart in February and March 1867, the northern part of Flacq in April, the Post of Flacq in April and May, and Rivière Seche and Grand River S.E. in May and June.

Sporadic cases had appeared throughout all the newly invaded districts in the end of the previous year, but the dates given above are those at which the epidemy appeared in force in the various places. To the south, again, of the epidemic centre (Albion), the disease appeared afresh at Bambous, already attacked during the previous year, and extended southwards along the west coast to the Morne, and the hills separating the districts of Black River and Savanne. It had already appeared among a detachment of the Royal Artillery stationed at Black River in December 1866; and this station had to be abandoned on account of fever in February 1867. The epidemy was raging, during June, all along the coast, from Black River Bay to the Morne. The disease had now, by the middle of 1867, spread round the whole littoral of the island, except on the south and south-east coasts of Savanne and Grand Port, occupying a coast-line of about 59 to 60 miles in length, and extending inland from one to four miles, according as the coast-belt was of greater or lesser breadth. As a severe epidemy, it ceased when the elevation reached 450 to 500 feet. Cases were met with, however, at Vacoa and Eau Coulée, in Plaines Wilhems, as high as 1500 feet, but it appears that they were not numerous, and were neither dangerous nor typical. The village of Bambous, the higher parts of the Petite Rivière sub-district, of Pailles (150 to 300 feet), and of Coromandel (175 to 300 feet), were not spared any more than the low plains. We have already said that the disease pursued, upon the whole, a forward course north and south from the epidemic centre. Thus, it was certainly severe in Pamplemousses before it assumed epidemic dimensions in Rivière du Rempart. It appeared in Rivière du Rempart earlier than in the south-east of Flacq. In the same way, its extension to the south of Albion was progressive. It reached Bambous before it attacked Black River Bay, and raged at Black River Bay before it reached Case Noyal and the country between that and the Morne. But while the disease thus extended north and south from the centre at which it first appeared, invading successively locality after locality in its progress, gaining a footing in the nearer districts before it invaded those at greater distance, yet it progressed in such a way that in a given locality it would appear earlier in a spot in advance of its line of march if the local conditions there were more favourable to its spread.

There seems abundant ground for saying that the epidemy showed a special partiality for low and marshy grounds. These were occupied by the advancing wave before the higher and better drained localities suffered, and in these marshy localities the disease was more intense.

The following are the fever death-rates, and total death-rates per 1000, in the districts reached by the epidemy in 1867 :—

	Fever Deaths per 1000 living.	Total Deaths per 1000 living.
Port Louis,	211·0	250·7
Pamplemousses,	81·2	96·1
Rivière du Rempart,	81·7	109·1
Flacq,	18·8	34·5
Black River,	137·4	154·4

The total deaths ascribed to fever throughout the Colony in 1867 was 31,920, out of a population of something over 310,000.

The district of Port Louis was that which suffered most. More than *one-fifth* of the inhabitants perished in 1867 from *fever alone*, and *one-fourth* died from all diseases. It need not be said that many of the deaths registered from other causes, such as bowel affections, were due to malaria. Those who survived were so prostrated by disease, that the living were scarcely able to bury the dead. In Port Louis district, the epidemy raged with greatest severity in April and May. The highest mortality in one day was 234, on 27th April 1867. It would be difficult to find any recorded epidemy in history, of which we have trustworthy accounts, that can be compared in fatality to this one, especially as it affected Port Louis.

The following table gives the deaths in a population estimated at 87,600 (Port Louis) during the second wave of the epidemy, *i.e.* from November 1866 to October 1867 :—

1866.		1867.									
Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.
309	337	371	1208	3812	6224	4970	2059	1296	620	463	274

The epidemy made its third start in November 1867. The cases in the districts already affected became more numerous in the last two months of the year, and continued to augment during the first half of 1868, although their intensity had greatly diminished. But the epidemy did not restrict itself to a recrudescence in previously affected districts : it now made its first incursion into Savanne and Grand Port—districts which had hitherto escaped. In January and February, fever appeared at the village of St. Anne and on the high grounds between Chamarel and the Baie du Cap, at Petit Cap, St. Martin, and on Bel Ombre estate in Savanne. It broke out in all these places almost simultaneously. All these localities are near to Black River, where the disease had been raging the previous year. Bel Ombre, which is the most distant of these places from Black River, is only five miles from the south-west boundary of that district. This is in favour of the view that the disease entered Savanne from the south of Black River. All the places in Savanne where the fever first made its appearance are more or less marshy, excepting the high grounds already mentioned. The immunity of these localities from fever during the previous year, when the fever was at its highest intensity, is more remarkable than the fact that they were now attacked. Dr. Reid states that the prevailing winds here are from the east and south-east, that is, blowing to, and not from the affected area. This may be thought by some to explain why the disease did not extend in 1867 across the mountain chain dividing Black River from Savanne. But during the first week in January, and not long before the fever made its entrance into Savanne, there occurred a hurricane, the main force of which was from the south-east and east, sufficiently strong to strip the trees of their leaves and to make many gaps in the forest screen that had intervened between the healthy and the malarious districts. Following this hurricane were rather strong north-westerly and westerly winds, with drizzling fine rain. Whether those westerly winds, following the hurricane, transported the germ over the hills, or whether the germ, or other cause of the fever, had been gradually making its way across the mountain barrier, cannot be other than a matter of opinion. That the hurricane and westerly winds had something to do with the appearance of the disease in Savanne, is rendered somewhat probable both from the sequence in point of time, and from the fact that a recrudescence of the disease was observed to succeed the hurricane in Port Louis, in Grand River N.W., in Coromandel, and generally along the west coast. While the disease was thus making its way in Savanne, it had also overpassed the other mountain barrier to which we have alluded, viz. that between Flacq and Grand Port. It will be remembered that in the previous year the epidemy reached the Flacq border of Grand Port, but it did not overstep the hills, which here, as at Black River, run down to the sea. Dr. Reid's account of its entry into Grand Port is as follows :—" Evidently carried over by the fresh northerly and north-easterly winds, which were prevailing at this season, intermittent fever further crossed the estuary of Grand River S.E. to the south-eastern littoral at Grand and Petite Sable, Bambou, Anse Jonchée, and old Grand Port, whence it crept along the creek of the Champagne River at Fernay." Having crossed these barriers on the south-west and south-east, the fever gradually occupied the whole of the two districts, advancing from the west along the shores of Savanne, and from the north-east along those of Grand Port, until the whole coast-line was invaded.

A still further extension has to be noticed. About the same time as the fever began to appear in the two districts just mentioned, it also began to advance into the inland and higher parts of the Flacq district, breaking out at the Camp de Masque and Trois Ilots, which had hitherto been spared.

It deserves to be observed, in passing, that Flat Island, which is situated about five miles to the north of the mainland, escaped entirely during the epidemy, and so far as I can make out it remains free from fever to the present day.

Such, then, is the course of the third wave of fever. The epidemy had now, after three years' progress during the warm season, and subsidence during the winter months, finally occupied the whole of the littoral. It thus took three years to pass round the whole of the island, which is about 104 miles in circumference. This third wave, by the progress of which the area affected was so considerably enlarged, was much less severe. The total deaths ascribed to fever in 1868 were 10,923, certainly a very high figure, but only about a third of that of 1867. The places of selection and the monthly distribution of the disease were similar this year to those of the previous two years.

As the fever approached old Grand Port, it first showed itself by derangement of the stomach and bowels in some cases, in others as an "influenzoid cold." The disease was altogether much milder than in the previously affected districts. Often it assumed the character of a simple remittent, with no marked chill, and without the depression and debility which characterised the fever on the western shores of the island.

The epidemy, the beginning and progress of which we have described, was undoubtedly one of malarial fever. It appeared under three forms, intermittent, remittent, and pseudo-continued. The comparative frequency of the different forms will be seen from the following tables of admissions into the Civil Hospital from January 1866 to June 1867, that is from the beginning of the epidemy until it had reached its acme :—

	1866.											
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Intermittent, .	2	3	9	13	28	53	50	27	18	29	35	72
Remittent, . .	12	11	5	8	22	12	11	4	8	16	11	29
Pseudo-continued,	45	35	44	55	60	57	39	47	50	40	78	61
Total, . .	59	49	58	76	110	122	100	78	76	85	124	162

	1867.					
	Jan.	Feb.	Mar.	April.	May.	June.
Intermittent,	329	263	482	417	367	350
Remittent,	34	316	621	573	194	146
Pseudo-continued,	61	64	67	41	14	10
Total,	424	643	1170	1031	575	506

The sudden increase of admissions from January 1867 is very striking, as is also the growing preponderance of the remittent form during the period when the disease was most prevalent and fatal. Respecting the intermittent form, it is stated that the different stages bore little proportion as regards violence and duration to each other; that the cold stage was often represented by a very slight horripilation or a simple vertigo (Beaugeard), and was sometimes altogether wanting. During the hot stage there was often copious and repeated vomiting or diarrhœa; sometimes there was suppression of urine, or this excretion was mixed with blood more or less altered; the sweating stage was rarely wanting.

In the remittent form the exacerbations were generally quotidian. When bi-quotidian, the case was grave. The remission might disappear, as was often the case when the disease tended to a fatal issue; or, on the contrary, the remittent might merge into the intermittent form when the case was progressing favourably. The pseudo-continued form was generally only a stage in the evolution of the remittent or intermittent forms, and seldom the primary disease. Anæmia was a marked characteristic of the fever: it was often developed with remarkable suddenness. Icterus was far from uncommon, and when well marked, and accompanied by vomiting, diarrhœa, hepatic enlargement, and pain, it indicated a grave condition. Enlargement of the spleen was a very common concomitant and sequel of the disease. Diarrhœa and vomiting, although frequent, were not as a rule dangerous, and were often the accompaniments of the intermittent type. Dysentery was a less common but a much more dangerous complication, and, according to Beaugeard, it differed in no respect from the idiopathic malady. When it occurred, no matter at what period, an intermittent fever often became converted into a pseudo-continued one. Sometimes the dysentery had the effect of at least temporarily diminishing the violence of the febrile symptom.

Epistaxis and other forms of hæmorrhage were sufficiently frequent, and so far from being critical only added to the danger of the patient by the resulting debility. But the gravity of the case doubtless depended upon the constitutional conditions of which the hæmorrhage was a symptom, rather than on the debility caused by the loss of blood. Among other complications observed were delirium, partial paralysis, palpitation, with a feeling of sinking at the epigastrium, general convulsions, and suppression of urine. When the delirium was associated with signs of severe cerebral congestion, such as intense headache, injection of the conjunctivæ, contraction, irregularity, or dilatation of the pupils, or with convulsions in the adult, the danger was great.

Dr. Power notices the prevalence of collapse as a cause of death. By malarial collapse, he says, " we mean a state of profound anæmia from the blood-poisoning effects of malaria : the symptoms come on with little or no warning. A patient has had one or two attacks of malarial fever (the fever itself not having been necessarily severe) : instead of convalescing as usual, the patient becomes weaker and unable to walk . . . Suddenly, after having perhaps (though not at all as a rule) complained of slight cramping pains in the muscles of the legs, the patient goes apparently to sleep, and, if observed shortly after, is found in a state of profound coma with pupils dilated . . . gently breathing in slight gasps ; body and extremities cold, pulse weak or not felt at all." This appears to be a form of the algid pernicious attack, which probably accounted for a considerable portion of the mortality. Certain it is, that many persons who started, say on a journey to the country, were overtaken suddenly by death on the way, and dead bodies of such unfortunate wayfarers were constantly met with on the road-sides or in the bushes close to the paths.

Dr. Beaugeard gives the complications of this fever in their order of frequency as follows :—1. Excessive enlargement of the spleen. 2. Hepatic congestion, with copious bilious vomiting and purging. 3. Severe bronchitis. 4. Arrest or excess of menstruation. 5. Great nervous debility. 6. Congestion of the brain. 7. Intense nervous headache. 8. Great delirium. 9. Dysentery. The fifth and sixth complications were those observed most frequently to lead to a fatal issue.

Dr. Rogers gives the following list of complications :—1. Algid symptoms, 1 in 20 or 30 cases. 2. Acute delirium. 3. Apoplectic symptoms. 4. Meningitis. 5. Typhoid forms, most frequently fatal. 6. Dysentery and diarrhœa. 7. Abortion. 8. Hæmorrhage.

From these statements it would appear that all kinds of complications met with in malarious fever were frequent during the epidemy, and that the malarial collapse of Power was only one of the many modes of fatal termination. All the varieties of pernicious attacks undoubtedly occurred. Convulsions were very common in children. Relapses were constant and persistent. Power concluded, from careful meteorological observations, that the main cause of relapses in the troops after reaching England was a sudden fall of the temperature; but that if after the temperature fell it remained low, the relapses did not increase; and finally, that the amount of humidity had no effect in determining relapses, provided the temperature remained steady.[1]

Dr. Power describes a form of dysentery which prevailed among the troops at Flat Island, who had previously suffered from fever on the mainland. "The stools were simply of thin, smoky, dark fluid (disintegrated blood and water), no sloughs until some time after the commencement of the disease, and not necessarily then, with no trace of feculent, or indeed of any solid matter; great depression; tendency to coldness of the body; but mind quite clear. After death, the lesions were either total sloughing of the whole of the internal coats of the large intestines, or merely a prominent state of all the glands. In this form of dysentery, ipecacuanha was of no avail, but large doses of the tincture of the perchloride of iron succeeded."

The pathological lesions found after death from fever, during the epidemy we have described, present no peculiarity that demands any lengthened remarks. Congestion of the membranes and of the brain substance were met with in those cases in which cerebral symptoms predominated during life. Lesions proper to pleurisy and pneumonia were rarely seen: sometimes the pleural and pericardial sacs contained yellow serum. The heart was flabby, its muscular tissue softened, its colour varying from a yellowish red-brown to a dirty rose tint. The mucous membrane of the small intestines was rarely congested, and when so, the part affected was towards the lower end of the ileum, but no ulceration or development of Peyer's patches, or of the solitary glands, was ever observed. When dysentery was a complication, the ordinary lesions of that disease were seen. The liver was enlarged, sometimes its weight was double, or more than double, that of the normal organ; its colour varied from dark red to a slaty tinge; its tissue was generally softened. Exceptionally the substance of the liver was firm, and when so its colour was slaty. The gall-bladder contained bile of varying colour and consistence. The spleen was generally enlarged, but occasionally it was found of its ordinary size. Most frequently it presented a dark red colour, and was either softened or diffluent,—its capsule being thickened in long-standing cases. The kidneys were frequently found congested. In the intermittent form they were sometimes softened, more or less exanguine, with brown or slaty patches at their surface, or with broad bands of a pale green in their cortical substance. Such were the principal lesions found by Beaugeard in the autopsies made in the Civil Hospital.

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[1] *Army Medical Report*, 1866.

The following are the more important circumstances that have been considered, singly or in combination, to have had an influence either in preparing the Colony for the outbreak of the epidemy, or in determining its occurrence:—

a. The appearance of the fever at Albion estate was, as we have seen, coincident with the cleaning out of a barachois or tidal inlet on the sea-shore, and the heaping up of the offensive, slimy mud on the banks, under the heat of the tropical sun.

b. For several years before 1866 the following important changes had been going on in Mauritius:—

(1) The *déboisement* of the interior. (2) An extension of the cultivation of the sugar-cane in the interior of the island. Coincidently with this, the estates along the coast became less and less productive from the increasing dryness of these districts, so that considerable tracts of land formerly under cultivation had to be abandoned. (3) A very rapid increase of the population. (4) During the years 1864–66 considerable disturbances of soil took place both in the neighbourhood of the town and in the country districts in connection with the construction of the railway. In Port Louis this was further increased by the excavations consequent upon the introduction of gas.

The following meteorological conditions have to be noted as preceding and accompanying the epidemy:—

a. A great inundation on the 12th of February 1865, the force of which fell upon the western side of the island, where, twelve months later, the fever broke out. This inundation brought down from the higher lands an immense quantity of mud and organic *débris,* which was deposited on the banks and at the mouths of rivers, and on flats along the coast. The town of Port Louis was flooded by this inundation.

b. This inundation was preceded and followed by great droughts.

In March 1865, the rainfall was below the average, and in April, May, and June, the Colony suffered from a severe drought.

c. In December 1865, very heavy rains fell, and these were again followed by droughts.

d. "The year 1866," as Dr. Meldrum remarks, "was one of the driest years upon record."

e. In 1867, the rainfall was again below the average, and the falls were at intervals, with rather considerable periods of dry weather intervening. The relatively driest months were January, March, May, June, and October. In January, the total fall was 50 per cent. below the average. Even in February, which was not so dry as the other months, the rainfall was 25 per cent. below the average. It is to be noted that in April the rainfall was above the average, but it almost all fell in five days. It was during the first six months of the year, and under these meteorological conditions, that the greatest mortality occurred.

f. The temperature was above the average both in 1866 and 1867; it was highest during the first six months of the latter year (1867), when the epidemy was at its height.

g. An unusual frequency of west and north-west winds prevailed in January, March, May, and June, and, speaking generally, throughout the whole season. This wind is popularly regarded as an unhealthy one. The above facts respecting the meteorology of the epidemic fever are mainly gleaned from Dr. Meldrum's valuable work.

We have already seen that inundations have been of frequent occurrence in the history of Mauritius. If floods could produce malaria in a country free from the miasm, one might have expected that former visitations of this nature would have been followed by (at least) some cases of malarious fever. The floods of 1861, if less severe than those of February 1865, were more prolonged, and there is reason to believe that more *débris* was deposited in the plains in 1861 than in 1865. No great change can have taken place in the physical condition of the Colony during the intervening four years, yet no outbreak of fever followed the floods of the former year. We must conclude, then, that the inundation of 1865, if it had any influence at all, only acted in preparing a soil suitable for the development of malaria.

Nor are we inclined to lay great stress upon the cleaning out of the barachois at Albion as a cause of the epidemy. It is probable that mud from such inlets had often before that time been utilised for manure; and, as we have already pointed out, the mischief was brewing in Black River district before the cleaning of this barachois was begun. Yet it is not improbable that the fœtid mud thus left exposed in the sun may have provided a *nidus* for the development of the malarial germ. The excavations for the railway, and those connected with the gas supply, do not appear to me to have had any influence in determining the epidemy. The greatest upturning of the soil in connection with the railway took place in 1864. No cases of fever occurred among the labourers while engaged at this work, and, what is more to the point, the fever did not break out in proximity to the railway, nor was it more prevalent along its course. The gas pipes in Port Louis were laid down between January 1864 and August 1865, but, as is remarked by Dr. Beaugeard, during this time neither the labourers nor the inhabitants of the streets, where this work was going on, appear to have suffered in the least.

Without entering into theories with which we are not now concerned, we cannot read the progress of this epidemy without feeling that no satisfactory explanation of it is possible without assuming the presence and multiplication in the soil of some living organism, growing in its season, becoming quiescent in the winter, spreading from a centre steadily in a more or less regular course where conditions favoured its growth. The question arises, Whence this germ? Was it introduced from without, or was it developed from some pre-existing germ, such as from that of common continued fever? Reasons drawn from analogy might be given in favour of either view. The probable introduction of the coffee-leaf disease into the Colony in cases of plants from Ceylon, makes it appear at least possible that the germ of malarial fever may have also been carried from some malarious country, such as India or Madagascar, with both of which places there is constant communication; and that having been so introduced, it found the conditions in the Colony at that moment favourable to its spread.

On the other hand, in our ignorance respecting the changes and transformations which minute organisms undergo, we cannot deny the possibility of the malarial germ having been developed from some allied organism indigenous to the island.

In speculating upon the introduction of malaria into Mauritius, and its epidemic outbreak, we should not lose sight of the fact that malarial fever appeared for the first time in the island of Réunion (Bourbon), which is situated nearly 100 miles to the south-west, in the year 1869. It has been abundantly proved that the fever is not contagious, but it has not been proved that its germ is not transportable. It is, upon the whole, more probable that it was introduced, than that a previously existing germ should have become developed in both Colonies at nearly the same time. It does not follow that such germ will grow wherever it is carried. Its growth and spread will depend upon the circumstances of locality and climate. If this view is not admissible, then I can give no explanation of the outburst of malaria in Mauritius in 1866–1868, and in Réunion in 1869

Since the great epidemy several smaller and localised outbreaks have occurred.

The rainy year 1877 proved a very feverish year all along the west and north coasts. But Grand Port and Savanne escaped, notwithstanding that the rainfall that year was in excess in these two districts. In 1882, an epidemy of great intensity ravaged the district of Grand Port. The rest of the island suffered but little, and even the neighbouring district of Savanne escaped. The rainfall that year was heavy, and came in downpours, alternating with considerable intervals of dry weather. I am not aware if the same distribution of the rains prevailed in Savanne. In 1882, the mortality in Grand Port district rose to 106·8 per 1000 (per ann.) in May, and to 105·6 per 1000 in June. The most remarkable character of this epidemy was the rapidity with which anæmia was established.

In 1889, fever was again prevalent in the same district, after an extraordinary inundation on the 19th of November 1888. This inundation was chiefly confined to the tract of country stretching from Rose Belle through Mare d'Albert and South Grand Port; and the area which suffered most was Mare d'Albert. Old Grand Port area was not affected. The subjoined table, which, for the sake of comparison, gives the fever death-rates for the first six months of 1888 along with the same months of 1889, shows the area, intensity, and period of this local epidemy:—

Monthly Ratio of Fever Deaths per 1000 of the Population in the Five Sanitary Areas of Grand Port for the first Six Months of 1888 and 1889.

Sanitary Areas.	Jan.		Feb.		March.		April.		May.		June.	
	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.
Mahebourg, . .	1·47	1·47	1·47	3·91	3·67	4·65	4·40	5·63	3·42	6·85	3·42	4·40
South Grand Port,	1·49	1·49	0·80	1·67	0·93	3·48	1·55	3·97	1·55	3·29	1·80	2·36
Old Grand Port, .	0·75	0·90	0·15	1·66	1·36	0·45	1·36	1·66	2·26	1·96	1·51	0·60
Mare d'Albert, .	0·78	1·17	0·78	0·68	1·46	6·94	0·97	7·72	1·27	9·38	0·68	5·28
Rose Belle, . .	0·63	1·38	0·75	1·13	0·88	2·52	1·26	2·90	1·64	4·16	1·01	6·44
Cent Gaulettes, .	0·50	0·70	0·60	1·61	1·30	2·31	2·21	3·12	1·10	2·11	0·80	1·91

Epidemies of a still more localised character, sometimes confined to the area of a single sugar estate, are observed almost every year. Thus, the year 1884, which was generally fairly healthy, was a feverish one on the estate of Beauchamps in Flacq. So in 1886, Wolmar in Black River suffered more than usual, although the year was one of the healthiest of recent years. I am not able to give any explanation of the cause of these outbreaks.

During the excavations for the Victoria Battery in 1887, the labourers suffered very severely from fever. The percentages of sick during the months of January to April were as follows:—

January.	February.	March.	April.
7·43	9·33	10·04	9·30

The disturbance of the soil in the malarious districts is fraught with danger, which is not observed to attend excavations in the non-malarious localities.

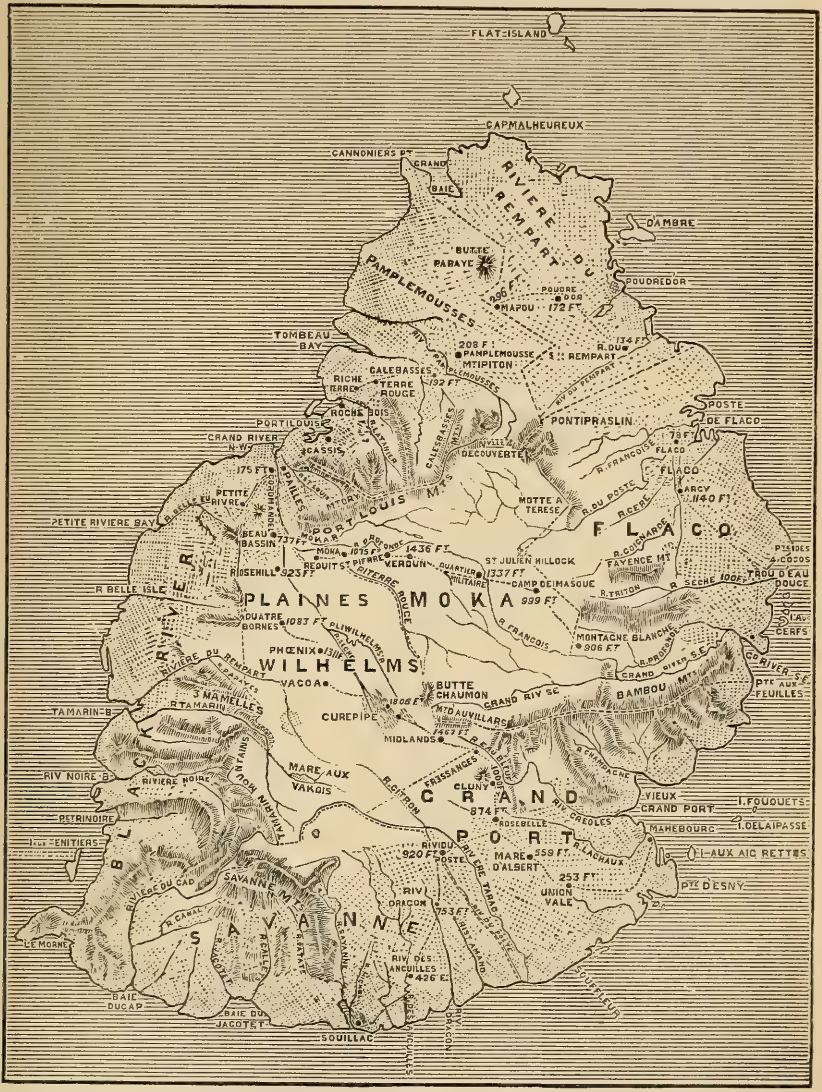
CHAPTER VII.

MAURITIUS.

THE PERIOD OF ENDEMIC FEVER.

Since the epidemy of 1866–68, malaria has been endemic in Mauritius, and has adversely affected the health of the population. We have observed that, during the epidemy, fever was only exceptionally met with at elevations above 450 feet. So, at the present day, fever can only be said to be generally endemic below 500 or 600 feet, although in some particular localities it reaches higher elevations than these. Thus at Rose Belle in the Grand Port district, at an elevation of 874 feet, fever is undoubtedly endemic; and during the local epidemies of 1882 and 1889, this locality suffered very severely. Numerous cases are also met with on the western slope of the island at Beau Bassin (727 feet), and even at Rose Hill (923 feet). The upper parts of the island, however, if not absolutely, are practically non-malarious. Within the region where the endemy rages, its intensity varies greatly in different localities according to altitude, the configuration of the country, and the character of the soil and subsoil. It may be stated, as a general rule, that the sea-coasts and the humid localities at elevations under 200 feet are those most affected. Other things being equal, fever diminishes in intensity according as the elevation above the sea-level increases. Thus in Lower Pamplemousses sanitary area, stretching from the sea-level up to 200 feet, the fever death-rate in 1887 was 42·9 per 1000; while in Pamplemousses area, at an elevation of 200 to 300 or 350 feet, the fever death-rate was 22·0. The Pailles area of Moka, with an elevation of 160 to 200 feet, had a fever death-rate of 37·3 per 1000; while at Upper Moka the ratio was 7·1. This general rule admits of many exceptions dependent upon local conditions. Even within the smaller area comprising the town of Port Louis, the fever death-rate varies greatly. Thus in the central area it was 16·6 in 1887; at Camp Malabar it was 41·1. The more densely populated, and better paved, localities are less malarious than the low-

MAP OF MAURITIUS SHOWING THE LIMITS OF ENDEMIC MALARIAL FEVER.



The shaded parts represent the limits of Endemic Fever.

lying, humid, and sparsely peopled areas. Rivière du Rempart, with its porous soil and general absence of marshy conditions, had (in 1887) a fever death-rate of 20·3; while that of Pamplemousses district, where marshy conditions are more prevalent, stood at 29·9.

In the upper and healthier regions the mortality curve differs considerably from that of the low and feverish regions, as will be seen by comparing the monthly percentage of deaths at Pailles, which is a low and decidedly malarious locality, with that of Quartier Militaire, which has an elevation of about 1340 feet. The percentages are calculated on the means of 1886–88:—

Months.	Pailles.	Quartier Militaire.	Months.	Pailles.	Quartier Militaire.
January,	5·6	7·3	July,	6·6	11·1
February,	8·7	7·3	August,	9·7	7·9
March,	10·3	7·4	September,	6·6	7·1
	24·6	22·1		22·9	26·1
April,	11·5	7·4	October,	5·6	9·4
May,	11·5	9·6	November,	6·6	6·0
June,	12·2	11·9	December,	5·0	7·4
	35·2	28·9		17·2	22·8

It will be seen that the deaths in Quartier Militaire are more evenly distributed over the year; while in Pailles, 45·5 per cent. of the mortality occurs from March to June. This is the result of the malarious influence.

The extent to which malaria now dominates the pathology of Mauritius will be apparent from the subjoined table, giving the fever death-rates per 1000 of the population from 1871 to 1886. It must, however, be borne in mind that rather more than one-half of the deaths are not medically certified, and that fever is often returned as the cause of death when it was only a symptom of some internal inflammation. The figures given below will thus exaggerate, to some extent, the fever death-rate:—

FEVER DEATH-RATES FROM 1871 to 1886.

1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
11·13	12·85	15·16	11·86	11·78	14·00	16·60	14·51	14·84	14·37	16·21	20·83	18·71	16·55	20·21	15·86

The proportion borne by the fever deaths to the total deaths for the ten years 1877–86 was as follows:—

1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
55·9	53·3	46·1	51·0	54·2	59·5	52·8	54·2	60·0	55·3

In addition to this unquestionably large mortality from malarial fevers, we find that 298 out of a total of 12,690 deaths were attributed to malarial cachexia in 1887. Diseases of the spleen caused only 8 deaths, or 0·6 per 1000 of the total mortality. Anæmia, general dropsy, and anæmic dropsy combined gave rise to 7·8 deaths per 1000; dysentery, to 68·4 per 1000 of the total mortality. It deserves notice that the still-birth rate rose about the time of the epidemy. The proportion in the year 1861 was 52·2, in 1887 it was 65 to every 1000 born alive.[1] The admissions and deaths from endemic diseases at the Civil Hospital of Port Louis furnish a valuable indication of the health condition of the Colony at the present time. In 1888, the total admissions for all diseases were 4317, and the deaths 331. The admissions and deaths from the more important endemic diseases were as follows:—

	Admissions.	Deaths.	Ratio of Admissions per 1000 Admissions.	Ratio of Deaths per 1000 Deaths.
Malarial Fever, . . .	1156	32	267·7	96·6
Malarial Cachexia, . .	122	14	28·2	42·3
Dysentery, ...	200	45	46·3	135·9
Diarrhœa, ...	39	3	9·0	9·1
Hepatitis, ...	7	0	1·6	0·0
Abscess of Liver, . .	3	1	0·7	3·0
Enteric Fever, . . .	3	1	0·7	3·0

Malarial fever, in some of its forms, thus accounted for more than a fourth of the admissions, and about one-seventh of the deaths.

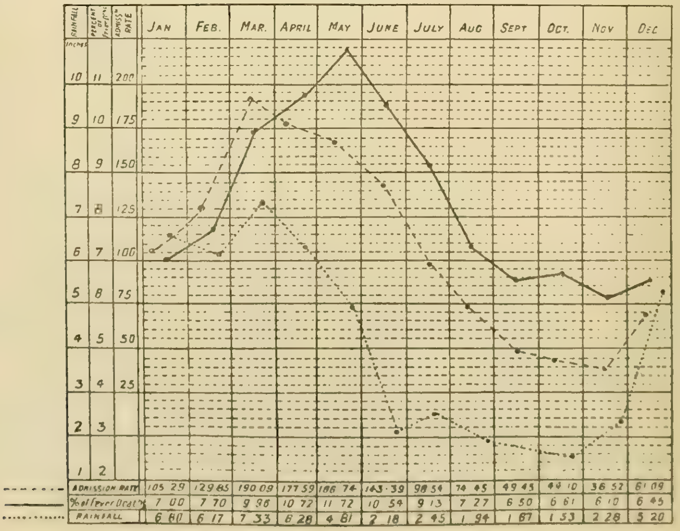
The seasonal distribution of malaria may be judged of either by the monthly admissions into hospital, or by the monthly death-rate. The subjoined table gives the mean monthly distribution of every 100 deaths from fever calculated upon the period 1871–86; the mean monthly percentage of admissions into the Civil Hospital for the years 1877–87; the mean monthly admission-rate per 1000 of strength among the troops in Mauritius (Port Louis) for the nine years 1877–85; the mean average monthly rainfall at eight stations for the sixteen years 1871–86; and the monthly mean temperature at the Observatory:—

[1] There are no statistics, that I am aware of, to enable us to judge whether there has been an increase or a diminution of phthisis since 1886. On looking over the deaths from chest diseases in the various sanitary areas, I am unable to arrive at any conclusion as to the relation of malaria to phthisis.

Months.	Average Rainfall, Inches.	Monthly Mean Temperature.	Monthly Percentage of Fever Deaths.	Monthly Percentage of Fever Admissions to Civil Hospital.	Mean Monthly Admission-rate per 1000 among the Military.
January, . .	10·32	78·7	7·00	10·22	105·29
February, . .	8·24	78·6	7·70	11·59	129·85
March, . .	10·40	77·9	9·96	16·79	190·09
April, . .	8·35	76·6	10·72	13·98	177·59
May, . .	5·86	72·9	11·72	12·35	166·74
June, . .	4·13	70·2	10·54	8·40	143·39
July, . .	3·79	68·8	9·13	6·05	98·54
August, . .	3·35	69·0	7·27	5·11	74·45
September, .	2·51	70·0	6·50	3·14	49·45
October, . .	2·53	71·7	6·61	3·74	44·10
November, .	2·78	74·7	6·10	3·12	38·52
December, .	6·57	77·5	6·46	4·85	61·09
	68·83	73·90	......	......	1279·10

It will be seen from the above table that 65 per cent. (64·93) of the fever admissions into the Civil Hospital, and 60·0 of those into the Military Hospital, take place during the first five months of the year. The fever admission-rate among the troops, beginning to rise in December, attains its maximum in March, and then declines to its minimum in November. The admission-rate will be seen to keep pace very exactly with the rainfall. The curves of the two, in fact, almost coincide, as will be seen by the annexed diagram. The deaths follow the same course as the admissions, but are two months behind—the maximum being reached in May.

Diagram illustrating the relation of the Mean Monthly Fever Admission and Death Rates to the Average Monthly Rainfall.



This leads us to inquire into the relation between fever and rainfall in the Colony. This relation has to be considered—first, as regards the influence of the total annual rainfall on the annual fatality and prevalence of fever; secondly, as respects the influence of the monthly distribution of the rainfall on the monthly distribution of fever deaths, and on the fever admissions to hospital taken as an index of fever prevalence.

The following table gives the annual fever death-rates and annual mean rainfall of eight stations for the sixteen years 1871–86:—

Years.	Fever Death-rate.	Rainfall.	Years.	Fever Death-rate.	Rainfall.
1871, . .	11·13	63·1	1879, . .	14·84	65·0
1872, . .	12·85	63·4	1880, . .	14·37	49·9
1873, . .	15·16	81·6	1881, . .	16·21	63·9
1874, . .	11·86	86·1	1882, . .	20·83	89·4
1875, . .	11·78	74·0	1883, . .	18·71	74·5
1876, . .	14·00	60·7	1884, . .	16·55	60·5
1877, . .	16·60	97·7	1885, . .	20·21	62·3
1878, . .	14·51	69·0	1886, . .	15·86	40·4

If we compare the eight driest of these years as regards fever mortality with the eight wettest years, we have the following result:—

Driest Years.		Wettest Years.	
Mean Rainfall, Inches, of Eight Driest Years.	Mean Fever Death-rate per 1000, of Eight Driest Years.	Mean Rainfall, Inches, of Eight Wettest Years.	Mean Fever Death-rate per 1000, of Eight Wettest Years.
58·0	15·14	79·6	15·53

The mean rainfall of the eight driest years was 21 inches under that of the eight wettest years, while the mean death-rate for the two series was practically the same. This does not indicate that rainy years are more unhealthy, upon the whole, than dry years; but it happens that if we look at the figures in a different way—that is, by comparing the least feverish and most feverish years as regards their rainfall, a somewhat different result is obtained:—

Eight least Feverish Years.		Eight most Feverish Years.	
Mean Death-rate per 1000.	Rainfall, Inches.	Mean Death-rate per 1000.	Rainfall, Inches.
13·16	66·4	17·51	71·2

Here we find the rainfall of the feverish years to be 4·8 in excess of the comparatively healthy years. It thus appears that in Mauritius, *taking it as a whole*, excess of rain tends, although only in a small degree, to excess of fever. I say, in Mauritius *as a whole*, for, although small in size, the Colony is not throughout its extent affected in the same way by rainfall.

A clearer view, however, of the influence of heavy or light annual rainfalls upon the fever mortality, will be obtained by observing the relation for individual years of the fever mortality and rainfall to the mean rainfall and the mean fever death-rates. Referring once more to the table of annual fever death-rates and rainfall (p. 763), it will be observed that the fever death-rate of the Colony has been gradually rising during these sixteen years. The recorded mean fever death-rate of the five years 1871–75 is 12·55 per 1000; that of the five years 1876–80 is 14·86; and that of the remaining six years is 18·06. The result of this is, that if we were to take a mean of the whole series, the low death-rates would appear towards the beginning, and the high death-rates towards the end of the period, whatever may have been the amount of rainfall. To obviate this source of error, we shall divide the sixteen years into three periods, two of five years each, and one of six years, and compare the fever deaths and rainfall of each year with the mean fever mortality and rainfall for the corresponding period.

Here, then, are the variations of the rainfall and fever mortality when viewed in this way:—

Year.	Fever Death-rates above or below Mean.	Rainfall above or below Mean.	Year.	Fever Death-rates above or below Mean.	Rainfall above or below Mean.	Year.	Fever Death-rates above or below Mean.	Rainfall above or below Mean.
1871	−1·42	−10·50	1876	−0·86	− 7·80	1881	−1·85	− 1·26
1872	+0·30	−10·20	1877	+1·74	+29·20	1882	+2·77	+24·24
1873	+2·61	+ 8·00	1878	−0·35	+ 0·50	1883	+0·65	+ 9·34
1874	−0·69	+12·50	1879	−0·02	− 3·50	1884	−1·51	− 4·66
1875	−0·77	+ 0·40	1880	−0·49	−18·60	1885	+2·15	− 2·86
						1886	−2·20	−24·76

In the years 1871, 1873, 1876, 1877, 1879, 1880, 1881, 1882, 1883, 1884, and 1886, the relation between the rainfall and the fever deaths was *direct*—that is, either both the rainfall and the fever deaths were in excess of the mean, or were both below it. In the other five years the relation was *inverse*—that is, there was either excess of rain with a low fever death-rate, or a deficiency of rain with a fever death-rate above the mean. We thus see that for Mauritius, as a whole, the direct relation is the more common.

The following will, perhaps, give a still clearer representation of what we mean:—

Direct Relation, Fever Deaths and Rainfall below the Mean.			Direct Relation, Fever Deaths and Rainfall above the Mean.			Inverse Relation, Fever Deaths above and Rainfall below the Mean.			Inverse Relation, Fever Deaths below and Rainfall above the Mean.		
Year.	Fever Deaths.	Rain-fall.	Year.	Fever Deaths.	Rain-fall.	Year.	Fever Deaths.	Rain-fail.	Year.	Fever Deaths.	Rain-fall.
1871	–	–	1873	+	+	1872	+	–	1874	–	+
1876	–	–	1877	+	+	1885	+	–	1875	–	+
1879	–	–	1882	+	+				1878	–	+
1880	–	–	1883	+	+						
1881	–	–									
1884	–	–									
1886	–	–									

In looking, however, into the effects of rainfall on fever mortality in the individual districts into which the Colony is divided, we find that it differs in a marked way according to locality. Along the western and northern coasts the relation is usually direct, while along the south and south-east coasts of Savanne and Grand Port, the *inverse* relation is the more frequent—that is to say, heavy rains and high fever mortality, and light rains and light fever mortality, are the rule in the districts of Black River, Port Louis, Pamplemousses, and Rivière du Rempart; while in Grand Port and Savanne, years when the rains are above the mean are most frequently years when the fever is below the mean, and *vice versâ*. In the central districts of Moka, Flacq, and Plaines Wilhems, the inverse and direct relations are about equally common. In illustration of this point, let us see the difference between the death-rates in wet and dry years in the districts of Pamplemousses and Savanne, on the east and south coasts respectively.

PAMPLEMOUSSES.

FIVE DRIEST YEARS.			FIVE WETTEST YEARS.		
Year.	Rainfall.	Fever Death-rate.	Year.	Rainfall.	Fever Death-rate.
1886, .	33·41	22·07	1877, .	79·52	21·60
1880, .	36·13	16·93	1873, .	78·45	17·28
1876, .	46·09	12·32	1874, .	69·29	14·88
1878, .	47·82	14·32	1882, .	68·55	24·17
1871, .	49·07	11·11	1883, .	58·12	24·86
Total, .	212·52	76·75	Total, .	353·93	102·79
Means, .	40·50	15·35	Means, .	70·78	20·55

SAVANNE.

FIVE DRIEST YEARS.			FIVE WETTEST YEARS.		
Year.	Rainfall.	Fever Death-rate.	Year.	Rainfall.	Fever Death-rate.
1886, .	54·81	11·51	1882, .	121·33	13·54
1880, .	59·20	14·68	1877, .	119·16	12·65
1879, .	66·17	11·92	1874, .	91·47	8·11
1884, .	67·88	9·44	1873, .	89·78	10·16
1885, .	67·90	13·85	1875, .	85·43	8·69
Total, .	315·96	61·40	Total, .	507·17	53·15
Means, .	63·19	12·28	Means, .	101·43	10·63

In Pamplemousses the five dry years are healthy years, the five wet years unhealthy, while just the reverse of this is the case in Savanne. Such are the facts respecting the influence of the amount of annual rainfall on the yearly fever mortality.

Let us now see in what manner the seasonal distribution of the rains influences the seasonal mortality from fever. The following table, which gives the monthly percentage of the total fever deaths for two series of years—(*a*) when the maximum rains fell in January and February, and (*b*) when the maximum rains fell in March. The maximum rains fell in January, with or without heavy rains in February, in 1871, 1872, and 1876. In 1880 the rainfall attained its maximum in February; after that it was dry. The maximum rainfall occurred in March in the years 1874, 1879, 1882, and 1886.

The monthly percentage of the total fever deaths from January to August in these two series of years respectively was as follows:—

MAXIMUM RAINS IN JANUARY AND FEBRUARY.						MAXIMUM RAINS IN MARCH.					
Months.	1871.	1872.	1876.	1880.	Means.	Months.	1874.	1879.	1882.	1886.	Means.
January, .	7·5	6·9	6·4	7·6	= 7·1	January, .	7·1	9·3	5·5	6·9	= 7·2
February, .	8·6	6·9	9·0	6·6	= 7·8	February, .	7·6	10·1	5·8	8·2	= 7·9
March, . .	11·1	9·6	12·0	9·0	=10·4	March, . .	8·7	9·6	7·6	9·5	= 8·8
April, . .	11·2	11·3	11·6	10·3	=11·1	April, . .	9·2	9·2	9·0	9·4	= 9·2
May, . .	10·7	12·6	10·8	11·9	=11·5	May, . .	11·3	9·9	15·22	10·2	=11·6
June, . .	7·9	10 7	10·0	9·8	= 9·6	June, . .	13·0	9·9	15·0	10·6	=12·1
July, . .	9·9	7·8	9·4	8·1	= 8·8	July, . .	10·5	9·0	10·3	7·8	= 9·4
August, . .	7·7	7·3	6·6	8·2	= 7·4	August, . .	7·7	7·2	7·5	8·0	= 7·6
Total Fever Deaths, .	3592	4300	4975	5175		Total Fever Deaths, .	4178	5411	7483	5839	

These figures suffice to prove that an earlier rainfall tends to accelerate somewhat the rise in the death-rate. We see the death-rate rising considerably in March when January and February have been rainy, while the rise is later when the heavy rains begin in March. This does not hold as respects every individual year of the series, but it holds true of the mean of the series of years. Even in those districts where rainy years are generally healthy ones (Savanne and Grand Port), the rule holds that the earlier the rains, the sooner does the seasonal rise in the fever death-rate make its appearance. The effect of heavy rains in these districts is to lower the number of fever deaths both in the first and second quarters, but it leaves the proportion of deaths in each of these quarters very much as in other years.

While it seems certain that rainfall has an effect, varying according to locality, upon the annual fever mortality, and that the earlier or later monthly distribution of the rains tends to accelerate or retard the period when the fever deaths attain their maximum, it appears to be no less evident that the annual fatality of fever and its seasonal distribution are only modified, not determined, by the rainfall. That other causes than rainfall affect alike the number of deaths from fever occurring in any given year, and also the period when such deaths take place, is evident (*a*) from the fact that in some years, such as 1885, fever is very fatal over the whole Colony, notwithstanding that the rainfall is scanty; (*b*) that heavy rainfall may be accompanied in a given district by a low mortality in one year, and by a high mortality in another year. Nor is the season of highest fever mortality always determined by the distribution of the rains, for the mortality in a given district tends to attain its maximum in a particular month, and often does so under widely different conditions of rain distribution. All that we can admit is that rainfall does exert a modifying influence on the monthly fever mortality, which, however, is really determined by seasons. Coming now to the influence of rainfall on fever prevalence, we may, in the absence of any reliable data, assume that whenever heavy annual rainfalls increase or diminish fever mortality, they at the same time increase or diminish the prevalence of fever. This will be generally true, although morbidity and mortality do not always correspond.

The annual number of admissions into the Civil Hospital of Port Louis is regulated to a great extent by other circumstances than the prevalence of disease, and that into the Military Hospital covers too short a period to enable us to draw any definite conclusions. Still, we may note that upon the whole the number of admissions into the Military Hospital is higher in the rainy years.

We have already seen that the annual rainfall and fever admission curves, constructed upon the averages of a number of years, coincide in a remarkable manner; but when we come to examine the admissions for individual years, this correspondence is by no means so evident. Let us first examine the return of admissions into the Military Hospital of Mauritius for the period 1877–87; remarking that the troops have been stationed, since 1886, (for ten months in the year), at Curepipe, in the centre of the island, and that the cases of fever during the last two years, dealt with in the table, have been mostly contracted by the soldiers when on duty in town. The means given in the table are those of the nine years 1877–85. The percentages given at the foot of the table are calculated on the average strength during the year.

MILITARY HOSPITALS.

Average Monthly Admission and Death Rates per 1000 from Paroxysmal Fevers for Eleven Years 1877–87.

Months.	1877.			1878.			1879.			1880.		
	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.
January,	15·80	...	11·17	104 65	...	5·15	143·17	...	3·20	58·51	...	3·88
February,	74·66	2·26	15·66	106·98	...	3·94	132·43	...	7·77	122·56	...	5·78
March,	176·07	2·25	8·12	168·60	2·31	3·45	128·92	...	11·87	114·44	...	5·39
April,	218·47	...	12·48	162·35	2·35	8·47	138·04	...	2·31	137·53	...	3·81
May,	171·94	...	1·34	209·93	...	2·97	262·62	...	6·44	131·14	...	0·49
June,	81·44	...	1·90	214·69	...	1·64	277·02	...	1·78	102·70	...	1·58
July,	75·00	...	1·59	101·10	...	5·71	241·49	...	1·11	84·24	...	2·05
August,	64·22	...	2·90	112·44	...	2·06	150·88	...	3·01	55·39	...	1·85
September,	30·00	...	0·61	68·56	...	0·76	72·24	...	2·79	47·76	...	1·50
October,	80·83	...	2 10	29·77	...	0·46	53·43	...	1·35	29·59	...	1·51
November,	68·73	...	9·22	41·78	...	1·06	36·67	...	0·45	35·09	...	0·69
December,	84·63	...	4·27	49·50	...	7·58	78·24	...	7·08	82·35	...	5·50
Annual Admission and Death Rates per 1000,	1145·1	4·53		1378·3	4·82		1662·8	...		1011·3	...	
Annual Rainfall at Observatory,			71·36			43·25			49·16			34·03

Average Admission and Death Rates, 1877-87—*continued.*

Months.	1881.			1882.			1883.			1884.		
	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.
January, . .	96·39	...	4·55	122·50	...	11·71	96·84	4·50	7·44	108·04	...	5·68
February, .	121·80	...	3·86	121·21	...	8 28	94·81	...	4·38	193·63	...	3·78
March, . .	176·64	2·99	2·18	243·02	...	17·53	192·71	...	4·99	209·55	5·30	6·75
April, . .	189·01	6·41	8·36	202·24	...	1·46	125·00	...	12·22	197·86	2·67	6·02
May, . .	106·74	...	4·78	209·50	...	0·87	78·05	...	6·25	151 83	...	12·81
June, . .	78·80	...	2·53	219 78	...	2·86	72·16	...	1·97	126·34	...	1·06
July, . .	32·67	...	4·43	134·37	...	2·76	58·17	...	0·72	76 08	2·72	1·55
August, . .	22·22	...	1·72	89·74	...	1·53	57·31	...	1·33	45·30	...	0·34
September, .	35·71	...	1·01	54·55	2·18	2·58	37·25	...	1·07	23·56	...	1·19
October, . .	27·71	...	1·83	55·55	...	0·91	31·61	...	1·19	45·45	...	2·85
November, .	28·79	...	3·19	36·12	2·25	0·74	19·70	...	1·41	49·41	...	2·21
December, .	67·75	...	6·88	35·47	2·21	4·83	21·43	...	4·02	97·70	...	1·56
Annual Admission and Death Rates per 1000, .	936·1	8·33		1450·2	7·89		894·3	5·15		1358·1	11·02	
Annual Rainfall at Observatory, .			45·32			56·06			47·69			45·80

Months.	1885.			1886.			1887.			Mean of Nine Years, 1877–85.	
	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Death-rate per 1000.	Rainfall.	Admission per 1000.	Rainfall.
January, . . .	201·78	...	6·70	30·73	...	2·13	50·24	2·40	9·84	105·29	6 60
February, . . .	200·60	...	2·16	49·64	...	4·26	131·58	...	3·37	129·85	6·17
March, . . .	300·91	...	5·73	59·81	2·40	3·81	138·09	...	12·76	190·09	7·33
April, . . .	227·85	6·33	1·41	41·56	...	3·12	130·43	...	2·91	177·59	6 28
May, . . .	178·91	...	7·40	62·18	...	1·88	95·60	2·73	4·68	166·74	4·81
June, . . .	117·65	...	4·36	32·58	...	0·65	66·32	...	1·68	143·39	2·18
July, . . .	83·80	2·73	2·18	19·09	...	2·22	56·45	...	1·96	98·54	2·45
August, . . .	72·62	...	2·76	23·70	...	0·74	35·05	...	2·11	74·45	1·94
September, . .	75·42	...	3·59	28·84	...	0·85	46·73	...	0·86	49·45	1·67
October, . . .	43·04	...	1·57	15·04	...	2·58	40·51	...	3·46	44·10	1·53
November, . .	30·44	...	1·59	16·66	...	1·19	67·01	...	0·60	38·52	2·28
December, . . .	32·79	...	5·16	16·66	...	6·31	38·01	...	2·41	61·09	5·20
Annual Admission and Death Rates per 1000, . . .	1477·6	9·74		396·1	2·41		902 5	4·44		...	
Annual Rainfall at Observatory, . .			44·61			29·74			46·64		48·44

The strength of the troops during the above period varied from 300 to 400, and their service in the Colony is never protracted. So that during the eleven years included in the table the men have been frequently changed. This takes away somewhat from the value of the table as the means of tracing effects of rainfall in the admission-rate. A study of this table, however, proves clearly enough that other causes besides rainfall regulate the monthly ratio of admissions. Thus, in 1877, after four months of unusually heavy rainfall, the admission-rate begins to fall in May; while in 1882, with a heavy rainfall confined to the first quarter only, the admission-rate continues high up to July. In 1885, with a low rainfall during the first quarter, and generally throughout the year, the admissions during the first half of the year are heavier than those in the first half of any other year of the series. This was also a very feverish year throughout the Colony. The years 1880 and 1881, both dry years, were also healthy years; but it will be observed that the rather abnormally high rainfall in April of the latter year did not have any effect in protracting the fever season.

The monthly percentage of admissions into the Civil Hospital, deduced as they are from larger numbers and from a more fixed population, is of greater value than the military statistics in tracing the influence of rainfall on the monthly fluctuations of fever:—

MONTHLY PERCENTAGE OF ADMISSIONS INTO THE CIVIL HOSPITAL, AND MONTHLY RAINFALL FROM 1877 TO 1887.

Months.	1877.		1878.		1879.		1880.		1881.		1882.	
	Per cent. of Admissions.	Rainfall.	Per cent of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.
January, . . .	4·14	11·17	11·12	5·15	14·90	3·20	9·69	3·88	5·02	4 55	5·73	11·71
February, . .	10·87	15·66	10·78	3 94	12·37	7·77	9·69	5·78	11·03	3·86	8·47	8·28
March, . . .	20·58	8·12	15·34	3·45	12·13	11·87	16·23	5·39	16 21	2·18	15·73	17·53
April, . . .	20·92	12 48	11·45	8 47	8·77	2·31	14·43	3·81	17·45	8·36	14·89	1·46
May, . . .	9·38	1·34	9·65	2·97	16·72	6·44	13·98	0·49	15·47	4·78	16·64	0·87
June, . . .	7 96	1·90	7·84	1·64	10·66	1·78	9 92	1·58	12·67	2·53	8·39	2·86
July, . . .	4·12	1·59	8·64	5·71	6·83	1·11	5·29	2·05	5·93	4·43	5·34	2·76
August, . . .	3 31	2·90	5·22	2·06	5·42	3·01	4·74	1·85	3·21	1·72	7·33	1·53
September, . .	3·10	0 61	4·75	0·76	3·24	2·79	4·85	1·50	3 95	1·01	7·25	2·58
October, . . .	3·85	2 10	5·63	0·46	3·24	1·35	4·17	1·51	3·62	1·83	3·74	0·91
November, . .	3·99	9·22	4·96	1·06	1·88	0·45	3·16	0·69	2·47	3·19	2·98	0·74
December, . .	7·76	4·27	4·62	7·58	3·83	7·08	3·83	5·50	2·91	6·88	3·51	4·83
		71·36		43·25		49·16		34·08		45·32		56·06
Total Admissions,	1482		1493		1698		887		1215		1310	

Monthly Percentage of Admissions—*continued.*

Months.	1883.		1884.		1885.		1886.		1887.	
	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions	Rainfall.	Per cent. of Admissions.	Rainfall.	Per cent. of Admissions.	Rainfall.
January,	11·58	7·44	10·48	5·68	10·44	6·70	15·35	2·13	11·26	9·84
February,	11·96	4·38	13·98	3·78	11·86	2·16	11·60	4·26	13·68	3·37
March,	17·18	4·99	11·60	6·75	21·49	5·73	13·30	3·81	21·52	12·76
April,	11·39	12·22	10·55	6·02	14·20	1·41	12·63	3·12	18·10	2·91
May,	8·82	6·25	11·04	12·81	13·59	7·40	9·91	1·88	9·69	4·68
June,	8·63	1·97	8·60	1·06	7·22	4·36	6·89	0·65	5·84	1·68
July,	7·02	0·72	7·06	1·55	3·66	2·18	5·19	2·22	5·70	1·96
August,	4·37	1·33	5·59	0·34	6·16	2·76	5·01	0·74	4·41	2·11
September,	4·65	1·07	3·70	1·19	1·55	3·59	4·65	0·85	2·56	0·86
October,	3·51	1·89	5·11	2·85	2·44	1·57	4·47	2·58	2·63	3·46
November,	3·80	1·41	5·03	2·21	1·73	1·59	3·99	1·19	1·77	0·60
December,	7·02	4·02	7·20	1·56	3·61	5·16	6·95	6·31	2·77	2·41
		47·69		45·80		44·61		29·74		46·64
Total Admissions,	1053		1430		2824		1654		1403	

If the actual number of admissions for any month in this table is desired instead of the percentage, this is to be got from the total admissions for the year and the monthly percentage by simple proportion, thus: Taking, for example, the month of October 1877, the proportion is stated thus—100 : 3·85 :: 1482 : 57.

Remembering the tendency of malarial fever to relapse, we are not to assume that the maximum number of admissions always indicates the month of maximum of fever prevalency. When, for example, in 1877 and 1881 there was only a slight excess of admissions in April, it is probable that this is more than accounted for by relapses of fever contracted in March. Bearing this, then, in mind, fever attained its maximum (so far as this is indicated by the admissions) in March, in the years 1877, 1878, 1880, 1881, 1883, 1885, 1887, and probably also in 1882; that is, in seven or eight out of eleven years. In 1878 and 1883, the fever attained its maximum in March, and in 1884, in February, before the maximum of rain fell. This shows that the season of greatest fever prevalence is March, independently of the distribution of the rains. In the year 1879, the maximum of fever was in May. This coincided with a rainfall about two inches above the mean in that month, following one of four inches below the average in April. The high number of admissions in January 1886 may perhaps be explained by the unusually rainy December which preceded, followed by the exceptional drought in January.

If, however, instead of looking at different years individually, we arrange them in series having some point in common, we shall be better able to judge of the manner in which, and the extent to which, fever prevalence is influenced by rainfall.

In the subjoined table we give the mean monthly percentage of fever admissions and mean rainfall for groups of three years each, the first characterised by dry weather during the first quarter, the second by heavy rains during the same quarter, and the third by comparatively heavy rains in April. Also, for the sake of clearness, we add the actual mean number of admissions for the same series of years in a second table:—

	Jan. to March, Dry. 1880, 1884, 1886.		Jan. to March, Wet. 1877, 1882, 1887.		April, Wet. 1878, 1881, 1883.	
	Mean Percentage of Fever Admissions.	Mean Rainfall.	Mean Percentage of Fever Admissions.	Mean Rainfall.	Mean Percentage of Fever Admissions.	Mean Rainfall.
January, . .	11·84	3·89	7·04	10·91	9·24	5·71
February, . .	11·76	4·61	11·01	9·10	11·26	4·06
March, . . .	13·71	5·32	19·28	12·80	16·24	3·54
April, . . .	12·54	4·32	17·97	5·62	13·43	9·68
May, . . .	11·64	5·06	11·90	2·29	11·31	4·67
June, . . .	8·47	1·09	7·39	2·15	9·71	2·05
July, . . .	5·85	1·94	5·05	2·10	7·19	3·62
August, . . .	5·11	0·98	5·02	2·18	4·27	1·70
Total Admissions and Rainfall,	1065	27·21	1183	47·15	1001	35·03

	Jan. to March, Dry. 1880, 1884, 1886.		Jan. to March, Wet. 1877, 1882, 1887.		April, Wet. 1878, 1881, 1883.	
	Mean Number of Fever Admissions.	Mean Rainfall.	Mean Number of Fever Admissions.	Mean Rainfall.	Mean Number of Fever Admissions.	Mean Rainfall.
January, . .	163	3·89	98	10·91	116	5·71
February, . .	159	4·61	155	9·10	140	4·06
March, . . .	177	5·32	271	12·80	202	3·54
April, . . .	163	4·32	253	5·62	134	9·68
May, . . .	149	5·06	164	2·29	142	4·67
June, . . .	108	1·09	103	2·15	121	2·05
July, . . .	78	1·94	70	2·10	92	3·62
August, . . .	68	0·98	69	2·18	54	1·70
Total Admissions and Rainfall,	1065	27·21	1183	47·15	1001	35·03

It will be seen that whether the first three months are rainy or dry, fever attains its maximum all the same in March. In the series of years 1878, 1881, and 1883, with scanty rains in January and February, and very dry weather in March, the rise in the fever admissions in this latter month is still very marked. This shows that March is *par excellence,* and apart from rainfall, the fever month in Mauritius. But the effect of heavy rains during the first three months shows itself in an augmentation of the admissions in March and April. Heavy April rains do not appear to have much influence upon the fever prevalence in April, but it will be observed that the admissions in June and July are in excess after heavy April rains. The following are the deductions respecting the influence of rainfall on fever which appear to me to be warranted by a consideration of all the facts :—

1. Fever has its own season, both of prevalence and mortality, independently of rainfall.

2. The effect of excess of annual rainfall depends upon the condition of the soil—in one locality a heavy annual rainfall increases, in another it diminishes, fever prevalence and mortality.

3. Epidemic conditions override the influence of rainfall in certain years and localities.

4. As a rule, a maximum rainfall in January and February will be followed by an earlier increase of fever prevalence and mortality than when the maximum is only attained in March.

5. When heavy rains increase fever prevalence, this increase of fever takes place in March and April, if the rainfall is excessive in the first quarter, and that of the fever deaths two months later. When the maximum rains occur in April, the period of fever prevalence seems to be protracted into June and July.

6. Inundations increase fever even in those localities, such as Grand Port, where a heavy annual rainfall has the contrary effect.

FORMS OF FEVER MET WITH IN MAURITIUS.

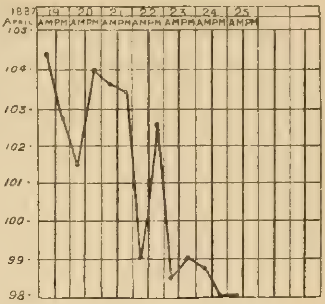
Although malaria generally manifests itself by fever, it does not necessarily do so. The constitution may be infected without the supervention of a febrile attack. It is no doubt true that the more the system is charged with malaria, the more readily and certainly will fever be induced; but in most cases—we do not say in all—the fever is to be looked upon as an accident or epiphenomenon arising in the progress of malarial poisoning from the action of some exciting cause. The ordinary exciting causes are *external,* such as exposure to solar heat, chill, or bodily fatigue; *internal,* such as gastric catarrh, irritation of the bowels or of the urinary organs; or, finally, *moral* influences, such as grief, terror, or anxiety. When the malarial infection is intense, as during an epidemy, it is seldom that one can trace the intervention of any external or moral cause as exciting the paroxysm; the poison infects the constitution, and also gives rise to the internal irritation that suffices to fire the train and produce the febrile explosion. Still, we must distinguish between malarial infection and malarial fever. The primary and essential action of malaria is to induce a specific cachexia. Two persons may sojourn for a time in the same malarious locality. The one is attacked with fever, the other not. It would be a mistake to conclude that the latter has escaped the malarious infection. He may, or he may not. It is more probable that he has to some extent suffered from the infection than that he has not, and the mischief may declare itself in an attack of fever months later, and after he has returned to a healthy country. Even if no febrile paroxysm occurs, the potency of the infection may manifest itself in rendering the person suffering from it liable to passive congestions—hepatic, gastric, intestinal, renal, pulmonary, or cerebral; to neuralgias—peripheral or visceral; to hæmoglobinuria, to diabetes, to local asphyxia of the extremities, and to other affections. He is, in short, under the influence of the malarious infection, although free from paroxysmal fever.

I have watched a child transferred from a healthy to a malarious locality. I have seen it gradually losing colour, spirit, strength, flesh, and appetite. I have observed it quitting its play to fall asleep before its usual hour for supper or for bed. I have noticed the skin moist with unusual perspiration in the afternoon or evening, the bowels becoming disordered, and the child complaining of headache and pains in the limbs. It is a poisoned thing. The infection is there as really as if it were suffering from a quotidian or a tertian ague. That this is so is often shown by the supervention of a severe, it may be a fatal, paroxysm on a change to a healthy but cold and changeable climate. Livingstone noticed this slow poisoning in a body of shipwrecked sailors at Kilimane, and he says that the sufferers sank like oxen bitten by the tsetse fly. This primary malarial cachexia is too often overlooked.

Still, fever is such a frequent, and, we may say, so unavoidable and important a phenomenon in the course of malarial poisoning, that its forms, types, complications, and accidents deserve study. I shall give a few diagrams illustrating the types of fever most frequently met with in Mauritius.

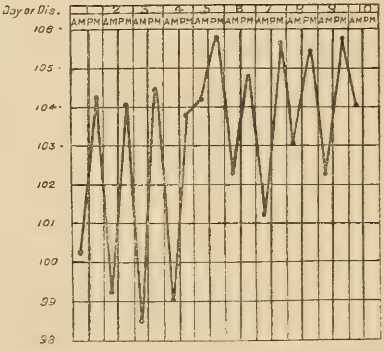
Case I. Initial attack of malarial fever.

Albert Baggs, aged 19, a sailor. Had remained for about a fortnight in the harbour of Port Louis, and had landed on several occasions. This was his first visit to a malarious port. On the fifth day after leaving Port Louis, and while at sea, he complained of headache and pains in the back, but the pulse and temperature were normal. Next day (19th April 1887), fever began, and ran the course indicated on the chart. I need not say that in this and the other cases to be mentioned (excepting, perhaps, Case VII.), the usual antiperiodic treatment was adopted.

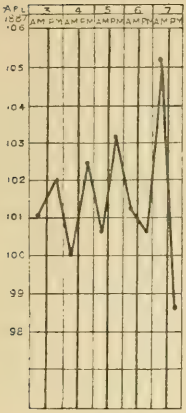


Case II. Remittent tertian—death.

Mercall, aged 26, a soldier, under treatment in the Military Hospital of Port Louis for fracture of the lower jaw, was progressing favourably when he was attacked with fever of the quotidian type. On one occasion only was the intermission complete. The cold stage was absent. Each morning, up to the 4th of January, he seemed quite well, and was able to walk about the ward, until compelled by a fresh accession of fever to take to bed in the afternoon. On the fifth day the fever assumed a graver form, the temperature rising higher in the afternoon, and not falling so low in the succeeding morning. There was vomiting and much nervous prostration, the fever terminating fatally on the tenth day by asthenia. The liver was found to be enlarged and pale; the spleen twice its normal size. Intestinal canal and other organs healthy. It will be remarked that the fever throughout maintained a tertian type, the temperature rising higher every other day.



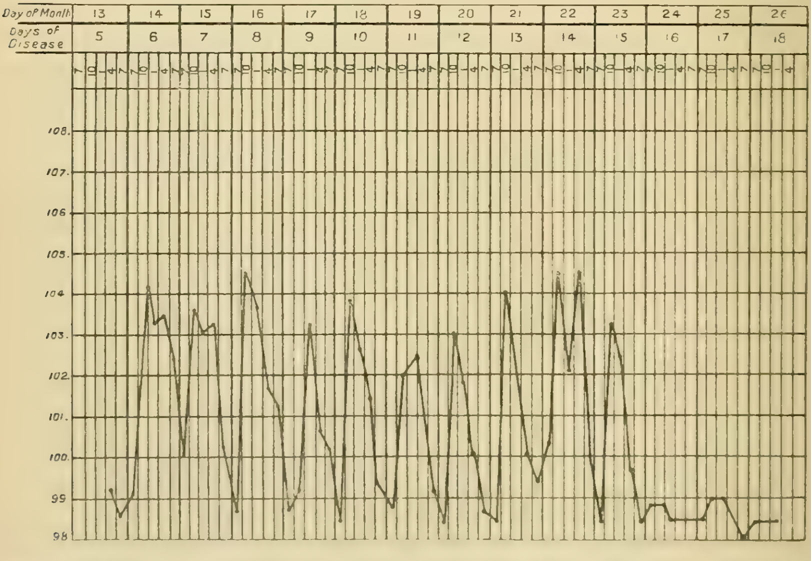
Case III. Remittent tertian type, with progressive, or ladder step, rise in temperature.



R. Hollander, aged 19, a native of Sweden, admitted to the Civil Hospital of Port Louis on the 3rd of April 1877. He had then been a month ill, on and off. On the 5th, his urine was observed to be highly coloured, acid, with a specific gravity of 1012, and albuminous. His pupils were contracted and unequal; spleen enlarged; he was delirious at night. On the 6th, it was noted that he had passed a very restless night; the pupils were equal, the liver was found to be somewhat enlarged. 7th. Slight delirium. Died suddenly at 10 p.m. of syncope; there was no coma nor convulsions.

Case IV. Tertian intermittent.

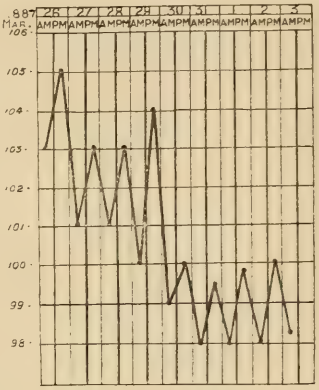
William Marshall, aged 23. Had been three months in the island, and living in a malarious locality. Was taken with fever five days before coming under observation. On the 13th of November 1886, when the diagram begins, he complained of thirst, want of appetite; his tongue was coated, his bowels regular, the spleen enlarged, and tender to the touch. The fever, which may be regarded as intermittent, although the temperature for the first few days stopped a little short of the normal, is of a double tertian type,



the alternate days corresponding. On the morning of the 7th, the temperature only descends to 100, from which we may conjecture that the fever began as a tertian remittent, or, what is not uncommon, a combination of a tertian intermittent with a tertian remittent occupying alternate days. We notice, too, a slight fall about noon, with a slight rise up to 4 p.m. during the first two days, and this mid-day notch is more conspicuous on the 14th. I do not know what it signifies, but it is often observed in fevers of this type. It will be seen that the tertian type persists even when the fever is passing off. I am indebted to Dr. Prout for this carefully observed case.

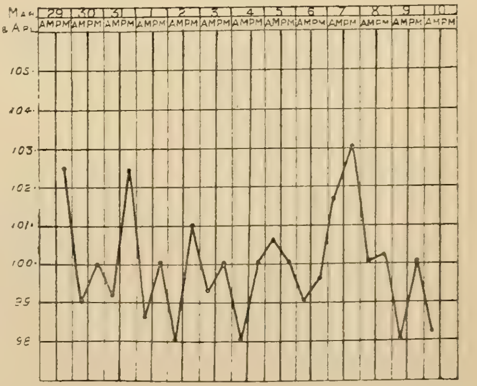
Case V. Quartan remittent.

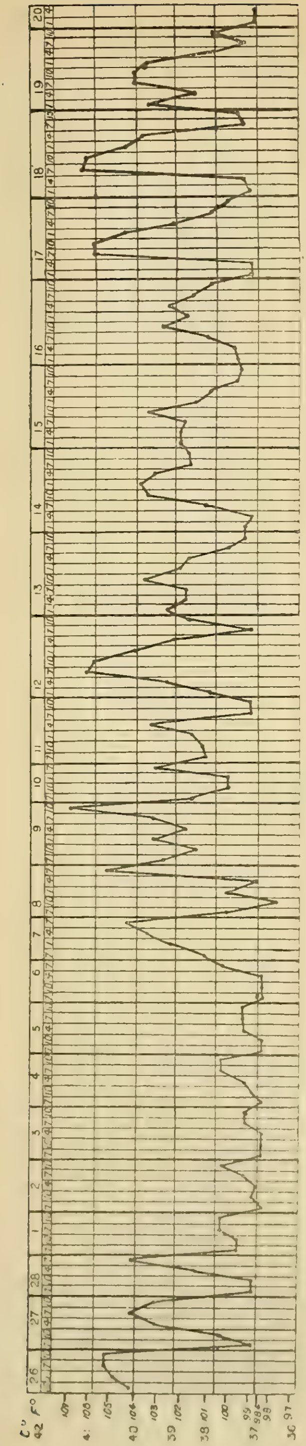
G. Spicsoback, aged 28, was admitted to the Civil Hospital, Port Louis, on the 26th of March 1877. He had already suffered from malarial fever in Johanna. Has been in Mauritius since the 24th of January. The fever, before his admission, was marked, according to his statement, by headache, pains in loins and limbs, rigors, vomiting, and cold sweats. The fever at first was of the remittent form and of the quartan type. The patient on the 30th fell into a state of collapse, with great difficulty of breathing, cold perspirations, and watery diarrhœa. Up to that time he had been treated with 30 grain doses of tannic acid every four hours. Quinine was then substituted, and he rapidly improved.



Case VI. Tertian intermittent and remittent.

Anicel, aged 28, was admitted on 29th March for a relapse of fever first contracted two months before. It will be seen to be of the tertian remittent and intermittent types. In early relapses the tertian type of remittent is, I think, more common than the quartan. The quartan remittent form is common, but quartan intermittents are rare in Mauritius.



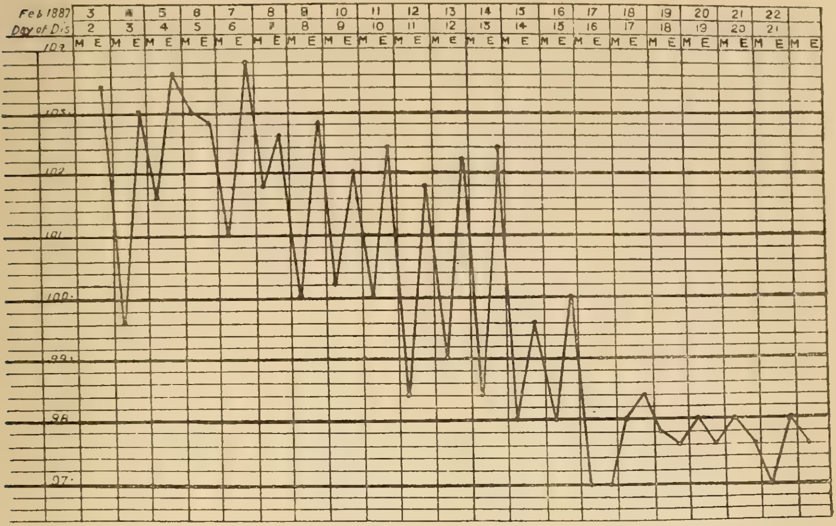


Case VII. Malarial fever, irregular type.

Moonoosamy, an Indian boy, 11 years of age. The patient was admitted on the 26th of February 1887, under the care of Dr. Prout, who followed the temperature with great perseverance, at first four times, and latterly eight times, in twenty-four hours. This chart is thus probably unique. I believe that quinine in large doses was not employed in this case during the period covered by the chart. The fever was irregular and obstinate; at one time remittent, at another time intermittent, and exhibited a variety of types.

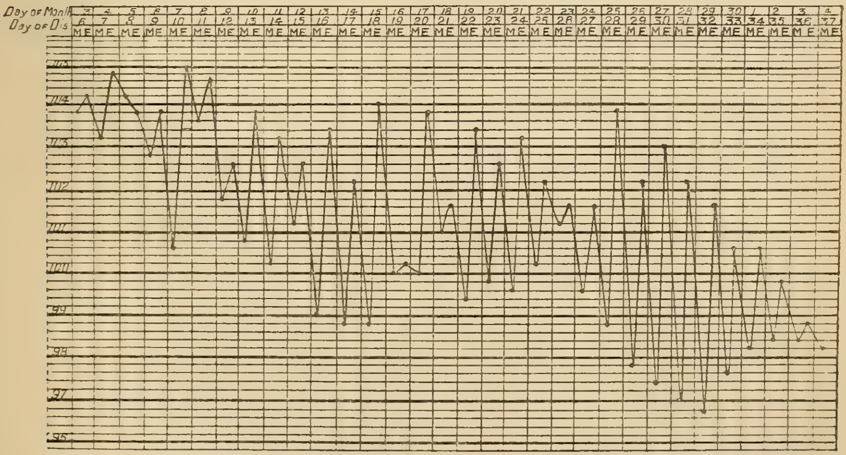
Case VIII. Malarial fever, typhoid form.

Vijayarghaden, aged 32, a patient who was found to have committed a murderous assault while of unsound mind, but although detained in confinement, was lucid and in good bodily health. The disease began with rigors, and was followed by heat and perspiration; the rigors were repeated on the second day of fever but not afterwards, but the patient continued to perspire freely at nights. Quinine, in 10 grain doses, three times daily, had no effect. On the tenth day of the disease the motions were watery and yellow; pain was complained of in the right iliac region, which was tender, and there was cough and bronchitis. Slight jaundice appeared on the seventh day; there was considerable prostration and stupor, but no delirium. After the tenth day, the treatment was mainly solution of iodine in iodide of potassium. The tertian character of the exacerbation is well shown.



Case IX. Typhoid fever, modified by malaria, tertian type.

Joseph, aged 7 years. The disease did not begin with rigors, but for the first two days the patient perspired freely, after that the skin was dry. Was treated with quinine in doses of 10



grains, three times a day, from the third day of fever; and from the sixth to the tenth day the same amount was given four times a day. From the eleventh day of the fever, had iodine in iodide of potassium. The patient's condition was one of prostration and agitation, with delirium, moving his hands as if in quest of something. There was a tendency to diarrhœa from the beginning, with bronchial catarrh. The accompanying chart gives the temperature from the sixth to the thirty-seventh day only. On the forty-seventh day, the temperature began to rise again. The urine was said to be gluey; pleuro-pneumonia declared itself, along with periostitis, followed by a fever, with more or less distinct remissions of a tertian type. This continued until the sixty-second day, when the patient recovered. The accompanying chart gives the first period of fever, showing the irregular character of the fever curve and the tertian exacerbations.

Typhoid Fever is returned as the cause of 27 deaths in 1889, which gives a ratio of 72·4 deaths per million. We may be sure, however, that this very considerably understates its actual prevalence. I believe that typhoid fever is increasing in frequency in Mauritius at the present day.

Relapsing Fever, or *Bilious Typhoid*, has not been observed in Mauritius for the last quarter of a century; but, as we have seen, it formed an important part of the Bombay fever, which formerly prevailed in the Colony.

Typhus Fever has never been observed in the Colony.

Dengue was introduced from India in 1873, but although it rapidly spread all over the island, it caused comparatively few deaths.

We have already given the dates of the different epidemics of *Cholera* by which the island has been visited, all of which have been clearly traced to importation from India. There can be no question that the freedom from the disease which the island has enjoyed since 1862, has been mainly due to a rigorous enforcement of quarantine.

Dysentery and *Diarrhœa* occupy a leading place among the causes of death in the Colony. The two diseases have caused, on an average during the ten years ending 1889, a proportion of 89 per 1000 of the deaths from all causes; and dysentery alone accounted for 72 per 1000 of the total deaths during that period. The death-rate from dysentery and diarrhœa during the same decade was 2·86 per 1000 living. These diseases prevail throughout the whole island, but are specially fatal in the lower and more malarious districts. For the monthly prevalence of dysentery, see diagram, p. 735.

Diphtheria is met with from time to time in localised outbreaks, affecting principally the general population.

Smallpox is not endemic in the Colony, but it appears in an epidemic form at long intervals, when it causes a great mortality.

The two most important outbreaks of which I have a record are those of 1841 and 1855. Since then the disease has been introduced on one or two occasions, but has been prevented from spreading by a rigorous system of isolation. In 1891, however, it has again assumed an epidemic form, having been introduced from Réunion.

Measles appears in epidemics at uncertain intervals, and has proved on more than one occasion very fatal. Rötheln, or German measles, often accompanied with sore throat, has appeared on one or two occasions in limited outbreaks.

Bronchitis is rare in Mauritius. The death-rate from bronchitis, "cold," and "catarrh" in 1889 was 0·94 per 1000 living.

Pneumonia is also comparatively rare, but I have observed it to be excessively fatal in some fever localities. The death-rate from the disease, in 1889, was 0·66 per 1000. The total deaths from diseases of the respiratory system in that year was 739 in a population of 372,664, which gives the small ratio of 1·98 per 1000 living.

Phthisis is moderately common—the death-rate in 1889 being 1·29 per 1000. So far as I can judge, the malarious districts suffer quite as much as the healthier regions of the interior. I have met with many cases in the basin of Grand River, which is one of the most feverish localities in the Colony.

Leprosy is very prevalent in Mauritius. In 1879, there were 762 lepers actually known, and it is certain that a considerable number, in whom the disease was in its earlier stages, were overlooked. The lepers actually known, at that date, were in the proportion of 1 in 465 of the population.

Syphilis caused a death-rate of 56 per million living in 1889. *Scrofula*, in the same year, gave rise to a death-rate of 0·02; *Rickets*, 0·01; and *Cancer*, 0·06 per 1000 living.

Elephantiasis is endemic in the island.

Liver Diseases are of frequent occurrence among the white population, and abscess is far from rare amongst this class. Yet it cannot be said that the community, as a whole, suffers to a corresponding extent, seeing that in 1889 the death-rate from all diseases of the liver, excepting cirrhosis, was in the ratio of 126 per million living.

Acute Anæmic Dropsy.—The Colony was visited in 1878 and 1879 by a peculiar malady which appears to have been introduced from Calcutta, where it was spoken of as "the new disease." It began by diarrhœa or vomiting, or both; with pain in the limbs, epigastrium, or abdomen, and with slight fever. There was frequently a rubeolar skin eruption, disappearing on pressure. These premonitory symptoms were speedily followed or accompanied by dropsy, especially of the lower extremities, which was the most prominent feature of the disease, along with marked and rapidly induced anæmia. The epidemy began in November 1878, attained its height in February 1879, had greatly diminished in frequency by July of that year, and had practically disappeared by the beginning of 1880, having caused a mortality of 729 out of a population of 357,339. This peculiar disease, which was almost restricted to the Indian population, and was very generally diffused among them, has not again been seen in the Colony.

CHAPTER VIII.

RODRIGUES AND RÉUNION.

RODRIGUES.—The island of Rodrigues is situated in the Indian Ocean, 344 miles east of Mauritius, in lat. 19° 41′ S., and long. 63° 23′ E. It is about 18 miles long by 7 broad. Although hilly, its greatest elevation only reaches 1760 feet. Some parts of the interior are wooded, but the coast lands are bare. The island is not marshy. The population in 1887 numbered 1826. The mean temperature F. and rainfall in inches (1876–86) is as follows:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Mean Temperature,	80·9	80·7	80·3	78·9	75·5	72·4	71·1	70·9	72·6	74·3	76·6	79·6	= 76·7
Mean Rainfall, .	5·44	6·64	4·76	4·70	3·22	4·88	2·89	3·26	1·83	1·58	2·39	2·91	= 44·5

Compared with Mauritius, the mean temperature is about 2° higher, and the rainfall 2 inches less. Rodrigues is more frequently visited by hurricanes than Mauritius.

The island is remarkably healthy, as will be seen by the annual death-rates from 1878 to 1887:—

1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
17·1	11·8	31·1	18·4	11·0	17·9	17·8	17·1	14·2	15·3

The high death-rate of 1880 was due to the introduction of typhoid fever (which does not appear to be endemic in the island) from Mauritius. The Colony is entirely free from malarious diseases. Dysentery causes (1887) 29·6 per cent. of the total mortality, and bronchitis 11·1.

RÉUNION.—The island of Réunion, or Bourbon, lies about 100 miles to the south-west of Mauritius. It has an area of 950 square miles, with a population of about 200,000. It is one vast mountain, rising to a height of 10,000 feet above the sea. The Piton Fournaise, at an elevation of 7200 feet, is an active volcano. The lower lands are fertile, and are to a considerable extent under cane cultivation. The capital is St. Denis, with a population of 30,000. The following are the temperature C. and rainfall in mm. at the Observatory of St. Denis:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	29·03	27·82	27·31	26·46	24·83	23·45	23·19	22·79	24·08	24·82	27·03	27·62
Mean Rainfall, .	225·00	144·40	149·70	136·60	39·88	25·80	22·90	27·60	21·60	26·50	57·00	182·10

Like Mauritius, Réunion was formerly non-malarious. It was in March 1869 that intermittent fever first appeared in the island—that is, one year after the epidemy had occupied the whole coast-line of Mauritius.

M. Delteil,[1] after having passed in review all the circumstances invoked to explain the appearance of fever in that year, confesses that no solution of the problem can be arrived at.

In Réunion, as in Mauritius, the disease appears to have started from a centre, and to have invaded successively, Champ Borne, Quartier François, St. Suzanne, St. Marie, St. André, Bras Panon, St. Benoit, St. Rose, and St. Philippe. The disease spread over all the coast districts. It is still endemic along the littoral. It is more intense at St. André, St. Benoit, and St. Paul than at St. Denis.

The death-rate of St. Denis is 40·2 per 1000. About one-third of the mortality is ascribed to malarial fever. Before the fever, the death-rate averaged 31·5 per 1000. In 1878, which was a particularly unhealthy year, the total deaths in St. Denis were 1339 (44·6 per 1000). Of these, 442 were due to malaria. Lymphangitis, of the pernicious type, is not unfrequently met with.[2] Dysentery is common.

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[1] *Arch. de méd. nav.* 1881.

[2] Azéma, "Lymphangite endémique des pays chauds ; des tumeurs lymphatiques," *Bull. de la Soc. des Sc. et Arts*, Réunion 1878.

AMERICA.

DIVISION I.

NORTH AND CENTRAL AMERICA.

CHAPTER I.

NORTH AMERICA.—THE NORTHERN REGIONS.

GEOGRAPHY AND CLIMATE.—The territory of Alaska, with the Sitkan and Aleutian Archipelagos; that portion of the Dominion of Canada lying to the north of 60° N. lat., including the North-Western Territories, better known as the Hudson Bay Territory (a country abounding in lakes, rivers, and swamps); and the Peninsula of Labrador, with Greenland,—although together having an area equal to one-third of the continent of North America, are so sparsely peopled, and so imperfectly known, that the most cursory glance at their climate and diseases will suffice. The region roughly indicated above has an extremely rigorous and inhospitable climate.

GREENLAND is much colder than Lapland at corresponding latitudes. The summers are short, the winters long and severe. Kane found the average temperature of the year in lat. 78° 37′ N. and long. 70° 40′ W. to be –3°·22. From October to April it was –23°·40, and from May to September, 25°·07. In February the temperature fell to –68°; in July it rose to 53°·9. This is the extreme limit of the inhabited country.

The annual mean temperature of four stations in Danish Greenland from south to north is given by Rink as follows: Lichtenau, 33°·2; Godthaab, 27°·8; Jakobshavn, 22°·6; Upernivik, 13°·3.[1]

The Danes have a number of colonies or settlements along the western shores of Greenland. The Danish resident population numbers 1000; the natives in 1870 numbered 9588. The monthly distribution of deaths is as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6·1	5·6	6·1	4·6	5·4	7·1	7·6	11·8	11·7	13·3	13·2	7·5

LABRADOR has an excessive range of temperature, rising in summer to 80° or 86°, and falling in winter to 20 or 30 degrees below the freezing point.

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[1] *Danish Greenland*, by Dr. Henry Rink, London 1877.

All along the coast of Hudson Bay the winters are long and trying, the summers short, but comparatively warm towards the south. At Albany River, which falls into the southern part of Hudson Bay in the latitude of London, the country is locked in ice and covered with snow from October to May. In May the snow begins to melt; in June the country is covered with verdure; July is a very warm month, and mosquitoes abound; August is still warm, but in September the nights become frosty. In October the pools and swamps again become frozen, and the long winter sets in.

On the western shores of the American continent the climate is much milder than in the interior or on the east. At Sitka, in 57° N. lat., the mean temperature of the year is 32°; that of summer, 54° or 55° F. The population of Alaska in 1870 was estimated at 26,843 natives, 483 Russians, and 1421 half-castes.

PATHOLOGY.—*Malarial* fever is nowhere endemic throughout this region. Romanowski observed three cases in five years at Sitka, and a few cases are occasionally seen in the southern parts of the Hudson Bay Territory.

Typhoid Fever has been observed in Greenland, Labrador, and Sitka. In the two former localities an epidemic which proved extremely fatal occurred in 1876 (Lombard).

Dysentery, which is seldom seen in Greenland, is said to be by no means rare both among the Esquimaux and Europeans at Labrador. *Diarrhœa* is stated by Rink to be the chief sickness in Greenland during the winter months, December to March. Sporadic *Cholera* appeared at Okak, in Labrador, in 1845, causing 409 deaths among the natives; and a similar epidemy was observed at Neuernhut, in Greenland, in 1847 (Lombard). It would have been interesting to know whether there was any connection between these two outbreaks.

Pneumonia and *Pleurisy* prevail throughout the whole of this region. In Sitka they were reported to have caused (1836–39) 6 per cent. of the deaths, as against the English ratio (1884) of 5·2 per cent. These diseases are also frequently met with in the Hudson Bay Territory as well as in Greenland, both amongst the natives and the European residents, where they are most prevalent in autumn, not in winter or spring.[1]

Typhoid Pneumonia is one of the fatal diseases of Alaska. "During the last six or seven years a violent form of typhoid pneumonia has been wasting whole settlements on the Kadiak and Aleutian coasts. The Creoles and natives alike yield at once to the disease."[1]

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[1] Rink, *Op. cit.*; also Dall, *Alaska and its Resources*, Boston 1870, p. 162.

Influenzoid Catarrh, similar to that observed in Iceland, is epidemic almost every spring in the Aleutian Islands. In Greenland, according to Rink, influenza is prevalent in autumn.

Lombard mentions the interesting fact that *Whooping-Cough* appeared for the first time in Labrador in 1875–76, after the arrival of two strangers from a southern station where it was then epidemic, although the strangers themselves were free from the disease.

Smallpox was introduced into Greenland from Denmark in 1733, when it proved excessively destructive. Since that time it has been epidemic on three occasions, viz. in 1800, 1809, and 1851. It was introduced into Alaska by Russians in 1838–39, and carried off about one half of the population. In several districts, Elliott says, "not a soul escaped, every human being was exterminated."[1]

Scarlet Fever and *Measles* are unknown in Greenland. The former appears never to have penetrated so far north in the Hudson Bay Territory as the region with which we are dealing; and measles only reached the Hudson Bay Territory in 1864, and Kadiak in 1874–75, when it is said to have been almost as deadly to the natives as smallpox.[2]

Phthisis is one of the most fatal diseases of Greenland; the natives of Alaska and the Aleutian Islands suffer to a still greater extent from the disease, which is also common in some parts of the Hudson Bay Territory (Hirsch). The Eskimo, the Aleut, the Kaniag, and the Indians suffer from it alike; it is, in fact, the principal cause of death among these tribes.

Leprosy is stated by Lombard to attack the natives of Sitka with great intensity, and to disfigure them to such a degree that their appearance is scarcely human; the nails, phalanges, and even the extremities, fall off successively. I find no notice of leprosy in the works of recent authors. The disease does not occur in Greenland, or among the natives of the Hudson Bay Territory. It appears to me not improbable that the affection supposed to be scrofulous, to which we shall now allude, may have been mistaken for true leprosy.

Scrofula is rare, or unknown, in Greenland. The information respecting Labrador is too scanty to enable us to form an opinion respecting its prevalence there. In Alaska, on the other hand, a disease, which has probably been confounded with leprosy, and which is by many considered to be scrofulous, is, next to lung diseases, the most common among the native races. "The disease," Elliott says, "takes the form of malignant ulcers, and eats into the vitals, and sloughs away the walls of the large arteries. . . . It is hard to find a village in the whole of the Alaska boundary, where at least one or more of the families therein has not got upon some of its members the singularly prominent scars that attest the disease." These are often seen about the neck and throat.

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[1] Elliott, *An Arctic Province*, London 1886.

[2] Elliott, *Op. cit.* p. 112.

Goitre is observed among some tribes in the southern part of the Hudson Bay Territory, but we have no accounts of it in the other regions with which we are dealing.

Rheumatism is one of the most common diseases in Greenland, but it is not so certain if acute articular rheumatism prevails there to a corresponding extent. In Alaska inflammatory rheumatism is prevalent.

Syphilis is by no means rare in Sitka, Alaska, and in the Aleutian Islands; but, notwithstanding the visits of whaling vessels to Greenland, and the existence of prostitution, syphilis is said to be altogether unknown.

CHAPTER II.

DOMINION OF CANADA AND NEWFOUNDLAND.

GEOGRAPHY.—The Dominion of Canada includes the northern regions formerly known as the Hudson Bay Territory and Labrador, to which we have already alluded. The southern part, which is settled, and with which we are now concerned, includes the coast Colonies of Nova Scotia, New Brunswick, and Prince Edward Island; Lower Canada or Quebec, Upper Canada or Ontario; the N.-W. Territories,—Manitoba, Kewatin, Assiniboia, Saskatchewan, Athabasca, Alberta, and British Columbia. The total area of the Dominion is estimated to contain 3,519,000 square miles, with a population, in 1881, of 4,324,810, which was estimated to have increased in 1889 to 5,075,855. The Indian population of Canada, according to the census of 1881, numbered 108,547, and it was believed to have increased to 124,589 in 1888; a result which is full of hope for the future of a race which has been looked upon as doomed. The chief towns of the Dominion are Montreal, with a population, in 1889, of 202,000; Toronto, 172,463; Quebec, 65,000; and Halifax, 44,000. The capital, which is Ottawa, had a population of 44,299 in that year.

The most prominent feature in the map of Eastern Canada is the great river St. Lawrence, terminating in the gulf of the same name. The eastern coast, which is broken by the projecting peninsula of Nova Scotia and by the islands of Cape Breton, Prince Edward Island, and Anticosti, present extensive stretches of well-wooded plain and undulating country, watered by the numerous tributaries of the St. Lawrence, and the smaller streams which fall into the Atlantic. Hills of no great height skirt the coasts of Nova Scotia and Cape Breton. Along the southern bank of the St. Lawrence stretch the Nôtre Dame hills, which are a continuation northwards of the Appalachians. On the north of the river is the Laurentian range, extending westwards, and forming the watershed between Hudson Bay and the St. Lawrence. To the west, the Rocky Mountains extend from the borders of the States to the

Arctic Ocean, rising in Canadian territory to elevations of from 15,000 to 16,000 feet, with an average elevation of from 7000 to 8000 feet above the sea-level.

The great inland lakes, forming the southern boundary of the Province of Ontario, have an area of 90,000 square miles, and permit of navigation from the head of Lake Superior to the Atlantic Ocean—a distance of 2384 miles. Numerous smaller, but still very considerable lakes, and the numerous rivers and streams draining into them, diversify the surface of Central Canada.

The country west of Ontario rises towards the Rocky Mountains in three steppes. The first of these, the Winnipeg plateau, has a width of 52 miles, and an average elevation of 800 feet. To the west of this stretches for 250 miles a second plateau, with an average altitude of 1600 feet. The third plateau, beginning at the 104th meridan, where it has an elevation of about 2000 feet, extends westwards for 465 miles to the foot of the Rocky Mountains, where it has an altitude of 4200 feet.

West of the Rocky Mountains lies the Province of British Columbia, and includes the islands of Vancouver and Queen Charlotte Island. The general surface of this province is mountainous, with elevated table-lands, valleys of varying extent, and numerous small lakes. The coast line is indented with numerous bays, and fringed with small islands.

CLIMATOLOGY.—A general idea of the climate of the Dominion will be obtained from the following table:—

AVERAGE MEAN SUMMER AND WINTER TEMPERATURE; AND MAXIMUM AND MINIMUM TEMPERATURE, AND TOTAL PRECIPITATION, FOR 1886, FOR VARIOUS REGIONS OF THE DOMINION.

Place.	Latitude.	Longitude.	Elevation.	Average Mean Temp. F.		Maximum 1886.	Minimum 1886.	Total Precipitation 1886.
				Summer.	Winter.			
			Feet.	°	°			Inches.
Charlottetown, .	46·14	63·10	38	62·1	19·1	...	-15·0	...
St. John, . .	45·17	66·3	116	58·6	21·5	85·7	-19·0	46·37
Halifax, . .	44·39	63·36	122	61·5	30·2	84·0	-8·0	57·50
Quebec, . .	46·48	71·12	315	62·2	15·0	85·5	-27·9	38·40
Montreal, . .	45·30	73·35	187	65·1	16·7	87·3	-23·6	38·48
Toronto, . .	43·39	79·24	350	67·5	24·6	89·5	-22·8	35·07
Ottawa, . .	45·26	75·42	236	64·8	14·3	89·1	-26·5	36·82
Winnipeg, . .	49·53	97·7	764	60·3	1·0	103·0	-44·6	14·84
Regina, . .	50·27	104·37	...	59·2	-2·4	106·5	-49·5	1·85
Battleford, .	52·44	108·16	...	60·0	12·5	...	...	...
Edmonton, .	53·32	113·29	2285	55·2	11·3	88·0	-57·0	7·22
Ft. Chipewayan,	58·43	111·19	...	54·0	-3·4	83·3	-49·0	14·58
Victoria, . .	48·24	123·19	10	57·8	39·0	85·0	17·0	28·29
Vancouver, .	49·21	122·52	...	62·0	33·8	...	...	...

The coast districts of the east enjoy a more equable climate than inland districts in the same latitude; the winters on the Pacific coast are much milder than on the Atlantic. In the North-West the temperature in summer rises very high.

Parkes gives the mean of winter temperature of Quebec as somewhat lower than this table would indicate, viz. 12°·8 F.; that of summer he places at 69°, which is considerably higher than the figures given above. He says that the variations of temperature in Quebec may reach 30° or 40° in twenty-four hours in winter. Toronto, being situated considerably to the south of Quebec, upon Lake Ontario, has a milder and somewhat more equable climate. Here the mean summer temperature is 67°·5, that of winter 24°·6.

The climate of Vancouver Island, on the Pacific coast, is similar to that of England, the winter being rather wetter, the spring somewhat colder, and the summer drier and hotter. On the mainland of British Columbia, the extremes are greater than at Vancouver Island.

PATHOLOGY.—*Malaria.*—In no part of this region is malaria endemic with any degree of intensity, and from the major part of it malaria is entirely absent.

In Nova Scotia and New Brunswick the admission-rate of the troops from paroxysmal fevers, from 1859 to 1866, was only 1·3 per 1000, with no deaths; and these few cases were no doubt relapses of fever contracted elsewhere. Prince Edward Island is non-malarious. Malaria is equally unknown in Quebec, notwithstanding the extraordinary fluctuations of temperature and the high summer mean which here obtains. Manitoba and the other North-Western Provinces, although abounding in lakes and marshes, are entirely or practically free from malaria—which is also absent from British Columbia.

The only region in the Dominion where malarial fever prevails to any marked degree is that of the great lakes, especially the shores of Lakes Ontario and Erie. Kingston and Toronto, situated on Lake Ontario, are undoubtedly malarious, although in a minor and diminishing degree. The proportion of deaths from malarious fever to the total deaths in the Province of Ontario, for 1870, was 4·33 per 1000; while in the other provinces it reached only 1 per 1000 (Lombard). The period when these fevers are most prevalent is from May to October, the worst month being August (Parkes).

Enteric Fever is met with throughout the whole of the Dominion. In the aggregate population of twenty-seven cities, the deaths from typhoid fever in 1887 were in the ratio of 0·55; in 1888, of 0·44; and in 1866, the ratio in nineteen cities was 0·36 per 1000 living.

The following are the ratios for the three years 1886–88 in some of the principal cities, arranged according to provinces from east to west:—

Nova Scotia.	Prince Edward Island.	New Brunswick.	Quebec.	Ontario.	Manitoba.	British Columbia.
Halifax, 0·21	Charlottetown, 0·46	St. John, 0·19	Montreal, 0·55	Toronto, 0·31	Winnipeg, 0·95	Victoria, 0·35
		Fredericton, 0·19	Quebec, 0·31	Hamilton, 0·34		
				Ottawa, 0·57		

Enteric fever is very common in the newly-settled districts of the West, and in the Province of Ontario. In 1887, the proportion of deaths in the cities of this province per 1000 living was 0·54, while in the whole province it was 0·26. It would thus appear to be twice as fatal in the towns as in the country. Quebec also suffers from enteric fever to a considerable extent. The disease appears to be less prevalent on the shores of the Atlantic and on those of the Pacific than in the newly-settled districts of the North-West.

Isolated outbreaks of what is termed typho-malarial fever are of rather frequent occurrence in the North-West. Thus we read of epidemics of this disease in the Kootenay District, British Columbia, near the Rocky Mountains, and at Battleford. They appear generally to occur in autumn, and cannot be traced to infection.[1]

Diphtheria forms from 38 to 40 per 1000 of the total deaths, and is widely prevalent in the coast provinces, in Quebec, Ontario, and Manitoba. Other throat affections (which probably include croup) form about 30 per 1000 of the total mortality.

Relapsing Fever is unknown in Canada. *Yellow Fever* has only twice been observed in Canada, viz. at Quebec in 1805, and at Halifax in 1861, but it forms no part of the pathology of the country.

Influenza.—None of the great epidemics that have visited North America have spared Canada.

Diarrhœal Diseases, including diarrhœa, dysentery, cholera infantum, gave rise in 1888–89 to 85·4 per 1000 of the total mortality at Charlottetown, Prince Edward Island; to 64·4 per 1000 at Halifax (N.S.); to 104·8 at St. John and Fredericton (N.B.); to 123·9 in six of the principal towns of the Province of Quebec; to 90·8 in seven large towns of Ontario; to 190·0 at

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[1] *Report of the Commission of the N.-W. Mounted Police for* 1887; Ottawa 1888.

Winnipeg in Manitoba, and to 76·3 at Victoria (B.C.). This class of diseases is more fatal in Canada than in England; in the former (1888–89) it formed 107·0, in the latter (including enteritis) 57·3 per 1000 of the total deaths in 1884. The provinces along the Atlantic coast are those which suffer least; the Province of Ontario occupies the second place, but here these complaints are considerably more fatal than in the coast provinces. Quebec shows an extremely high death-rate from diarrhœal diseases; which also appear, so far as any inference can be drawn from the mortality of a single locality for two years, to be prevalent and fatal in Manitoba and British Columbia.

Dysentery is not distinguished in the statistics to which I have had access from other diarrhœal diseases. The only measure by which its comparative prevalence can be estimated is the admission and death rates from the disease among the troops stationed in Canada from 1859–66, which were 25·0 and 0·10 per 1000 respectively.

Asiatic Cholera was introduced into Quebec in 1832, from which it spread along the St. Lawrence and its tributaries as well as along the shores of Lake Ontario. It appeared again in Quebec in 1849, having been imported by immigrants from Europe; and at various points in scattered epidemies towards the end of 1853, spreading in the spring and summer of 1854 over a great part of the country. Outbreaks of a limited nature occurred in Halifax in 1866 and 1871, and at Stratford (Ontario) in 1866 (Hirsch).

The *Eruptive Fevers* do not present any peculiarities in distribution or prevalence that call for remark.

Respiratory Diseases, excluding throat affections, are prevalent along the Atlantic coast. In New Brunswick and Nova Scotia they form from 130 to 150 per 1000 of the total deaths. In six towns of Quebec, the proportion, in 1888–89, was 94·7, in Ontario 116·8, and in Winnipeg 118·1, per 1000 of the total mortality. The ratio in Victoria (B.C.) for the same years was 90·4 per 1000. This class of diseases is thus most fatal along the Atlantic coast, and least so along the shores of the Pacific. In the interior of Canada respiratory diseases appear to be less frequent than in England, where they form about 161 per 1000 of the deaths from all causes.

Let us now compare the admission and death rates of the troops from pneumonia and bronchitis during the latest years of their occupation (1859–65), with the ratios for the troops stationed in the United Kingdom.

Pneumonia gave a mean admission-rate among the troops of 12·24 per 1000, and a death-rate of 0·85 per 1000 of strength. The admission and death rates respectively from this disease in

England were 5·25 and 0·64 per 1000. Pneumonia thus appears to have been more prevalent and fatal in Canada than in England. Canada was the starting-point of the great pandemy of pneumonia which spread over the continent from 1812 to 1825.

Bronchitis was rather less prevalent, but slightly more fatal, among the troops in Canada than among those stationed in the United Kingdom. At home the deaths from this disease (1859–71) were 0·227 per 1000; in Canada for the years 1859–66 they were 0·309.

Croup is signalised as common in the eastern coast provinces.

Phthisis, like respiratory diseases, is more fatal in the east coast provinces than in the interior, and least so in British Columbia. In 1888–89, phthisis formed 141·2 per 1000 of the total deaths in St. John and Fredericton (N.B.); 190·0 at Charlottetown (P.E.I.); 122·2 at Halifax (N.S.); 88·5 in six towns in the Province of Quebec; 94·5 in seven towns of Ontario; and 90·4 at Victoria (B.C.). The ratio in England and Wales, for 1844, was 92·9 per 1000 of the deaths from all causes. Phthisis is thus more fatal in New Brunswick, Prince Edward Island, and Nova Scotia than in England, but less so in the other parts of Canada.

Liver and Spleen Diseases are not more frequent in Canada than in other temperate and non-malarious countries.

Rheumatic Diseases are moderately common, but we do not have the means of tracing their relative prevalence in the different provinces, excepting the records of the health of the troops stationed there. From these it appears that the admissions for rheumatism per 1000 was 26·0 in Nova Scotia and New Brunswick, and 35·8 in Canada, as compared with 43·1 in the United Kingdom.

Cancer is frequently met with in all parts of the Dominion.

Syphilis is very common and malignant among the natives in British Columbia, and to a less extent in Ontario. It is by no means rare among the colonists. *Scrofula* is as widely diffused in Canada as in England.

Leprosy is met with in New Brunswick, but is restricted to an entirely limited area, and to the descendants of one family of French settlers. It was first observed in 1844 at Nacadie and Nequal, near the Bay Chaleur. A leper hospital is maintained by the Government at Newcastle, which, in 1882, contained twenty-four inmates, and there were three or four suspected cases not interned. M'Phedran gives notes of nine cases of leprosy observed amongst Scotch Highlanders settled in the Ainslie district of Cape Breton, where the disease is supposed to have originated *de novo*.[1] I have met with no later accounts of this outbreak.

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[1] *Canadian Journal of Med. Science*, Jan. 1882.

DISEASES OF THE INDIANS OF CANADA.

Malarial Fever, of the intermittent type, was the most prevalent sickness amongst the Indians of the *Six Nations* living on the banks of Grand River, on Lake Erie, when Stratton wrote his account of their diseases in 1849.[1] It formed one-fifth of the cases treated, but it was of a mild type.

Bilious Remittent and *Remittent Fever*, under which headings typhoid fever, then imperfectly known, may have been included, formed one-fifteenth of the diseases treated; and nearly half of the recorded deaths (23 out of a total of 54). These fevers appear to have been the most fatal of the maladies from which this tribe of Indians suffered.

Diarrhœa and *Dysentery* are moderately prevalent among the Indian tribes; and *Cholera Infantum*, known as "the summer disease," is far from rare.

Smallpox has frequently caused great ravages among the Indians. During the years 1862–63, vast numbers of the Indians of Vancouver Island perished from this disease.

Measles and *Scarlet Fever* are of frequent occurrence amongst the different tribes, and cause a very considerable mortality. Measles is said to have been introduced into the Hudson Bay Territory in 1846, when it proved very destructive.

Phthisis is one of the greatest scourges of the Indian race when they are subjected to the restraints of civilisation. Other diseases of the respiratory organs are at least as common among the Indians as among the white settlers.

Syphilis.—The following is a slightly condensed description of the *Ottawa Disease*, generally supposed to have been a form of syphilis, as given by Stratton:—

Languor, lassitude, dull and almost constant pain between the orbits and on the upper part of the nose; sometimes pain in the frontal and malar bones; ulcerations of the nostrils and soft palate, or even destruction of the hard palate. Pains in the bones generally, increased by wet weather. Small ulcers formed in the groin, on the inside of the thighs, and at times on the arms, covered by a thick crust about an inch square, disclosing, when removed, an indolent scooped-out ulcer. In some cases an eruption appeared in the groins and on the inside of the thighs. In others, indolent, scrofulous-looking superficial ulceration of the axilla, groin, thighs, and arms was observed; but there was no particular eruption or raspberry-growth about the angles of the mouth. It appears to have been propagated by the ordinary intercourse of social life.

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[1] *Edinb. Med. Journal*, vol. lxxi., 1849.

NEWFOUNDLAND.

GEOGRAPHY AND CLIMATE.—Newfoundland is situated in the Gulf of St. Lawrence. It has an area of 40,000 square miles, with a population of 196,411.

Newfoundland is eminently a land of rivers, lakes, and marshes. The coast line is very irregular, being indented by numerous bays. The east and south coasts present a ragged appearance from the multitude of small inlets by which they are notched, and the number of outlying islets which surround them.

The maximum temperature at St. John's, on the south-east coast, in 1886, was 80°·0 F., the minimum 0°·0, and the mean 42°·16. The total precipitation was 46·71 inches. At Point Rich, on the north-west coast, the maximum for the same year was 68°·0, the minimum 10°·0, and the mean 36°·77. The total precipitation was 38·65 inches.

PATHOLOGY.—*Malaria.*—Intermittent fevers are not met with on the mainland; but the case is different as regards the two small islands of St. Pierre and Miquelon, belonging to France, on the south coast. Rey states, on the authority of Gras, that paroxysmal fevers rage towards the end of summer on the island of Miquelon, among a portion of the population living near a marsh.

Typhoid Fever is met with both on the mainland, where it is occasionally epidemic, and in Miquelon, where it is met with in spring and autumn. At St. Pierre, it is said by Lombard to form 58 per 1000 of the total mortality,—a proportion which is probably exceptional. Still, we are warranted in concluding that typhoid fever is essentially the endemic fever of the country.

Diphtheria is not unknown in Newfoundland, but I have no means of determining its prevalence.

Dysentery is extremely rare, and *Diarrhœa* is only moderately prevalent.

Asiatic Cholera has not reached this island.

Respiratory Diseases are amongst the commonest diseases of the island, and *Phthisis* is also of frequent occurrence.

Syphilis is said by Gras to be extremely rare in Miquelon; and it is by no means prevalent amongst the permanent population of the mainland.

CHAPTER III.

THE UNITED STATES.

GEOGRAPHY.—The United States of America, excluding Alaska, extend from the Atlantic to the Pacific, and from 24°·20 to 49° N. lat. The area is estimated at 3,603,884 square miles, comprising (1880) 41 States, 5 Territories, and 1 District, with a population of 50,152,866.

This immense country exhibits the greatest variety of climate, from the cold regions of the north to the almost tropical lands bordering the Gulf of Mexico in the south; and from the parched uplands of the Western Plains and of New Mexico to the humid tracts along the Lower Mississippi.

No less marked is the diversity of soil and vegetation. Here we meet, and on a large scale, with swamp and prairie, arid plains and heavily wooded tracts.

All altitudes are represented, from the sea-level to the elevated plateaux of the Appalachians and the lofty ranges of the Rocky Mountains.

The United States thus afford the means of studying, on a large scale, the effects of temperature, rainfall, altitude, soil, and social conditions on the health of a community, which includes side by side the Caucasian, Indian, and Negro races.

In the Report on the Mortality and Vital Statistics of the United States, as returned at the Census of 1880,[1] the whole country is divided into twenty-one districts, or "Grand Groups" of counties, having reference primarily to the physical characteristics of the country, but secondarily and indirectly to climate, race, occupation, and density of population. As these Grand Groups will have to be frequently referred to in the sequel, I shall enumerate their leading features as succinctly as possible, by condensing the description there given.

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[1] *Report on the Mortality and Vital Statistics of the United States*, by John S. Billings, Parts I. and II., Washington 1885.

1. *North Atlantic Coast Region.*—This comprises a strip of land, 50 to 75 miles wide, along the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. Surface, undulating and hilly, with little swamp. Mean annual temperature, 40° to 50° F.; mean rainfall, 40 to 50 inches; mean elevation, 100 to 500 feet. Density of population, from 45 to 90 per square mile.

2. *Middle Atlantic Coast Region.*—This comprises the coast counties of New York, New Jersey, Delaware, Maryland, and Virginia. Surface, low and sandy; on New Jersey coast, lagoons and marshes. Temperature, 45° to 50° F. in the north, 55° to 60° F. in the south; rainfall, 45 to 55 inches. Average density of population, 45 to a square mile; in New York and northern New Jersey, over 90 to a square mile.

3. *South Atlantic Coast Region.*—This region includes the coast counties of North and South Carolina and Georgia. Surface, low and swampy. Temperature, 60° to 65° F.; rainfall, 50 to 60 inches. Average elevation, under 100 feet. Density of population, from 6 to 18 on coast of North Carolina and northern part of South Carolina; for the rest of the group, 18 to 45. Coloured population over 50 per cent.

4. *Gulf Coast Region.*—This group includes the entire State of Florida and the coast counties of Alabama, Mississippi, Louisiana, and Texas. Much uninhabited swamp land. Temperature, 70° to 75° F.; rainfall, over 55 inches. Density of population, under 45 to a square mile. Coloured population numbers from 35 to 60 per cent. of the whole.

5. *North-Eastern Appalachian Region.*—This comprises all that portion of Maine, New Hampshire, Massachusetts, and Connecticut not comprised in the coast strip, with all Vermont and the northern portion of New York. Surface, mountainous, hilly, or broken. Temperature, 40° to 45° F.; rainfall, 35 to 45 inches. Elevation mostly above 500 feet, with mountains rising to 3000, 5000, or even 6000 feet. Population under 45 per square mile.

6. *Central Appalachian Region.*—This comprises parts of New York, Pennsylvania, and Maryland. Surface, hilly; narrow parallel ridges rising from 1000 to 2000 feet above the narrow intervening valleys, which again have an elevation of from 500 to 1000 feet above the sea. Temperature, 40° to 45° F.; rainfall, 35 to 40 inches. Density of population, under 45 per square mile. Coloured population, below 7 per cent.

7. *Lake Region.*—This comprises those parts of New York, Ohio, Indiana, Illinois, Michigan, and Wisconsin, bordering on the great lakes. Temperature, from 40° to 45° F. in the north to 45° to 50° F. in the south; rainfall, 30 to 40 inches, except in North Michigan, where it is 20 to 25 inches. Elevation under 500 feet.

8. *Interior Plateau.*—This group comprises that portion of the plain stretching from the base of the Appalachians eastwards and westwards. It consists of three regions, not contiguous, viz.:—(1) Western parts of New York and Pennsylvania; (2) the south-eastern corner of Pennsylvania, containing the cities of Reading and Philadelphia; (3) central portions of Virginia and North Carolina. Surface, broken and hilly, with little swamp land. Temperature, 45° to 50° F.; rainfall, 40 to 45 inches in that part east of the Appalachians; 30 to 35 inches in the northern portion. Density of population, 45 to 90 per square mile. Coloured population, about 35 per cent. in Virginia and North Carolina.

9. *South-Central Appalachian Region.*—This is a continuation to the south-west of the Grand Groups 5 and 6; including portions of Virginia, West Virginia, the Carolinas, Kentucky, Tennessee, Georgia, and Alabama. In the north the country is similar to Grand Group 6, but as we proceed southwards

there is a gradual rise in the ridges, and a tendency to break into peaks of from 6000 to 7000 feet. The valley occupied by the Shenandoah in Northern Virginia is to the south occupied by the branches of the New River and the heads of the Tennessee, and in Tennessee by the river of that name. The mountains in this region rise from 1000 to 6700 feet above the sea, and the valleys have elevations from 500 to 2000 feet. Temperature, varying according to altitude, from 40° to 55° F.; rainfall, 35 to 45 inches in the north, and 50 to 60 inches in the south. Density of population, under 45 per square mile. Coloured population, below 17 per cent. of the whole.

10. *Ohio River Belt.*—This belt includes those parts of Ohio, Indiana, Kentucky, and West Virginia which border on the Ohio River. Surface broken; rivers, for the most part, flow in deep narrow valleys, bordered by high bluffs and broken hills; area of bottom-land limited. Temperature, 45° to 55° F.; rainfall, 45 to 50 inches.

11. *Southern Interior Plateau.*—This includes the section of the Atlantic plain which extends across South Carolina and Georgia, with the region in Central Alabama and Mississippi lying between the Appalachian region and the Gulf coast belt. Mostly level and heavily timbered, a large extent of the surface being what is known as "pine barrens." Temperature, 60° to 70° F.; rainfall, 50 to 60 inches. Density of population, 18 to 45 per square mile. Elevation, mostly below 1000 feet. Coloured population forms 60 per cent. of the whole.

12. *South Mississippi River Belt* lies along the Mississippi from the neigbourhood of the coast to the mouth of the Ohio, including the river counties of Kentucky, Tennessee, Missouri, Arkansas, Mississippi, and Louisiana. Surface, an alluvial bottom-land, lying low with relation to the river, and subject to overflow, with large areas of swamp; vegetation rank. Temperature, 60° to 70° F.; rainfall, 50 to 55 inches. Elevation above sea-level, 100 to 500 feet. Coloured population, 60 per cent.

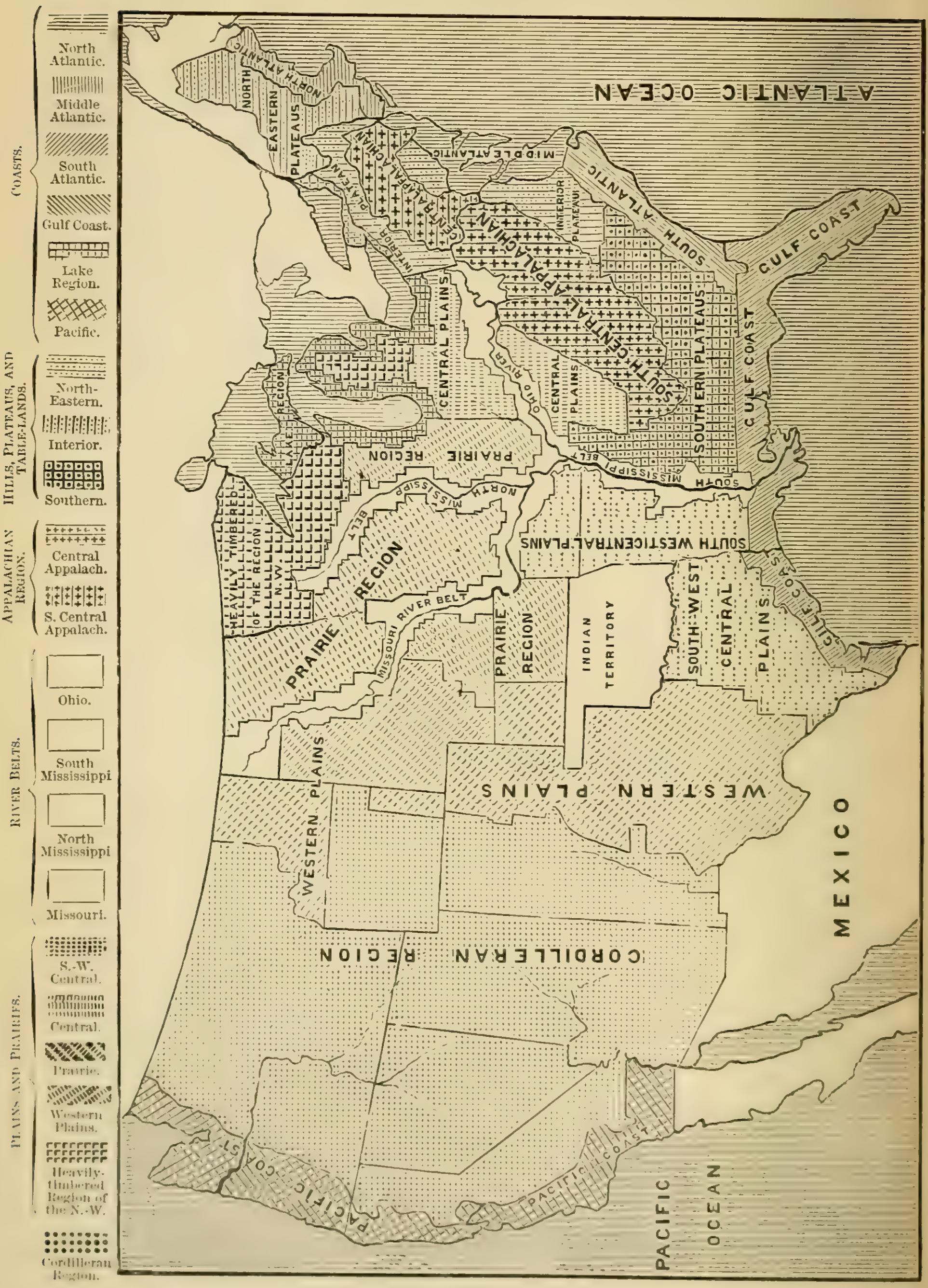
13. *North Mississippi River Belt.*—This region extends from the mouth of the Ohio to the head of the Mississippi, including portions of Missouri, Iowa, Minnesota, Illinois, and Wisconsin. Temperature, 40° to 45° F. in the north, and 50° to 55° F. in the south; rainfall, 30 to 40 inches in the north, and 40 to 50 inches in the south. Density of population, 18 to 45 per square mile. Elevation rising to 1000 feet.

14. *South-West Central Region.*—This group includes the north-western part of Louisiana, the southern part of Missouri, all Arkansas, except such portions of these States as belong to the South Mississippi River belt, and Central Texas. Surface, mainly upland and heavily timbered, with the exception of parts of Texas. Temperature, 60° to 70° F.; rainfall, 35 to 50 inches. Density of population, 6 to 18 persons per square mile.

15. *Central Region, Plains and Prairies.*—This includes the plateau running across the northern part of Ohio and Indiana, and the central portions of Kentucky and Tennessee. Surface, undulating; timber largely cut away. Temperature, 50° to 60° F.; rainfall, 40 to 45 inches. Density of population, from 45 to 90 per square mile. Elevation, 500 to 1500 feet.

16. *The Prairie Region.*—This group comprises most of the State of Illinois, the southern part of Wisconsin, nearly all of Iowa, Southern Minnesota, the northern part of Missouri, the eastern half of Kansas, and a considerable portion of Nebraska, with that part of Dakota lying to the east of the Missouri belt. Surface nearly level. Forests only along watercourses, in the faces of bluffs and tops of knolls. Soil, deep, fertile, and retentive of moisture, and not free from swamps. Temperature, 50° to 55° F. in the south, and 40° to 50° F. in the north;

MAP OF THE UNITED STATES, SHOWING THE TWENTY-ONE GRAND GROUPS.



rainfall, 35 to 40 inches in the east, and 20 to 25 inches in the west. Density of population, 18 to 45 in the south and east, below 6 in the north and west. Elevation, 500 to 1000 feet in the east, gradually rising to 2000 and 3000 in the west.

17. *The Missouri River Belt.*—This comprises a narrow strip across Missouri, with portions of Eastern Nebraska, Western Iowa, and Central Dakota, including in the main a broad area of rich bottom-land, subject to overflow in the southern part. Higher up the river, in Dakota, we enter the sub-humid section of country with a drier climate. Temperature, 40° to 45° F. in the north, 50° to 55° F. in the south ; rainfall, 10 to 20 inches in the north, 30 to 40 inches in the south. Density of population, 18 to 45 per square mile. Elevation, 500 to 2000 feet.

18. *Region of the Western Plains.*—This region extends westwards from the border of the prairie region, including parts of Texas, Kansas, Nebraska, Colorado, Wyoming, Dakota, Montana, and New Mexico. Surface, a monotonous rolling expanse, covered with sparse clumps of bunch-grass, cactus, yucca, etc. Temperature, 65° to 70° F. in the south, 40° to 45° F. in the north ; rainfall, 10 to 20 inches. Density of population, under 2 per square mile. Elevation, 1000 in the east, to 4000, 5000, and 6000 feet in the west.

19. *Heavily-Timbered Region of the North-West.*—This comprises parts of Minnesota, Wisconsin, and Michigan. Dense forests, numerous lakes, and a considerable area of swamp. Temperature, 40° to 50° F. ; rainfall, 30 to 40 inches ; atmosphere, humid. Elevation, 1000 to 1500 feet. Density of population in Wisconsin and Michigan, 45 to 90 per square mile.

20. *The Cordilleran Region.*—This includes the country westward from the Rocky Mountains to the Cascades and Sierra Nevada, consisting mainly of high table-lands, crowned by a succession of mountain ranges. It comprises Arizona, Utah, Nevada, and portions of Colorado, Montana, Wyoming, New Mexico, California, Oregon, and Washington Territory. The mountains are timbered, swamps and stagnant water rare. Temperature, 40 to 50° F. in the north and centre, and 60° to 65° F. in the south ; great extremes between summer and winter, and day and night ; rainfall, below 10 inches in the central and south-western portions, and somewhat greater in the eastern and northern portions. Density of population, below 2 per square mile. Elevation, 4000 to 10,000 feet.

21. *Pacific Coast Region.*—This comprises the coasts of Washington, Oregon, and California, lying between the ranges of the Cascades and Sierra Nevada and the coast. It has a well-defined wet and dry season ; the former corresponding to the winter. Temperature, from 55° to 65° F. in the south, and from 45° to 55° F. in the north ; rainfall, above 60 inches in the north, and below 20 inches in the south. The mean density of the population is below 2 persons to the square mile, except in the vicinity of San Francisco, Los Angeles, Sacramento, and Portland. The elevation varies from the coast line to 3000 feet.

CLIMATOLOGY.—The subjoined table gives the monthly temperature and rainfall of stations representing the North, Middle, and South Atlantic regions ; the Lake region ; the Mississippi Valley, the southern plateau of Arizona and New Mexico, and the Pacific coasts, North, Middle, and South :—

East Atlantic Coast.

	Waterton Arsenal, Massachust's, 41° 21′ N. lat. 71° 09′ W. lo.		Fort Columbus, New York, 40° 42′ N. lat. 74° 1′ W. lo.		Fort Moultrie, Charleston Harbour, S. Carolina, 32° 45′ N. lat. 79° 51′ W. lo. alt. 25 feet.		Ogletborpe Barracks, Georgia, 32° 05′ N. lat. 81° 07′ W. lo. alt. 40 feet.		Fort Capron, Florida, 27° 30′ N. lat. 80° 20′ W. lo. alt. 30 feet.	
	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.
		°		°		°		°		°
January,	2·87	27·23	2·78	30·18	2·39	50·36	3·57	54·44	4·45	62·75
February,	2·85	25·40	2·92	30·44	2·33	52·41	2·18	55·05	2·72	64·44
March,	3·30	33·75	3·44	38·28	4·06	58·68	7·11	58·64	3·01	69·77
April,	3·70	44·98	3·33	48·65	1·75	65·44	2·91	67·15	3·85	73·63
May,	3·75	55·17	4·78	59·30	4·08	73·42	3·43	76·46	4·27	76·92
June,	3·61	64·74	3·46	68·93	4·15	79·01	4·65	79·84	14·28	79·02
July,	2·64	70·60	3·17	74·83	6·72	81·72	8·79	81·46	5·16	82·50
August,	4·41	69·02	4·70	73·16	6·58	80·94	8·06	80·81	6·81	82·38
September,	3·00	61·71	3·31	65·78	5·83	76·89	4·07	77·02	9·27	80·85
October,	3·85	48·84	3·40	54·19	2·44	67·88	1·95	67·12	5·36	75·00
November,	3·98	37·58	3·59	43·32	1·79	59·76	1·19	59·67	2·21	68·56
December,	4·11	29·02	3·93	33·52	2·80	52·51	3·42	52·69	1·59	62·63
1st Quarter,	9·02	28·79	9·14	32·96	8·78	53·81	12·86	56·04	10·18	65·65
2nd ,,	11·06	54·96	11·57	58·96	9·98	72·62	10·99	74·48	22·40	76·56
3rd ,,	10·05	67·11	11·18	71·25	19·13	79·85	20·92	79·76	21·24	81·91
4th ,,	11·84	38·48	10·92	43·67	7·03	59·98	6·56	59·82	9·16	68·73
Totals and Means,	41·97	47·33	42·81	51·71	44·92	66·56	51·33	67·38	62·98	73·21

	Lake Region.				Central Region.							
	Fort Mackinac, Michigan, 45° 51′ N. lat. 84° 33′ W. lo. alt. 728 feet.		Detroit, Michigan, 42° 20′ N. lat. 82° 58′ W. lo. alt. 580 feet.		New Port, Kentucky, 39° 05′ N. lat. 84° 29′ W. lo. alt. 500 feet.		Fort Kearney, 40° 38′ N. lat. 98° 57′ W. lo. alt. 2360 ft.		Jefferson Barracks, Missouri, 38° 28′ N. lat. 90° 15′ W. lo. alt. 472 feet.		New Orleans, Louisiana, 29° 57′ N. lat. 90° 50′ W. lo. alt. 10 feet.	
	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.
		°		°		°		°		°		°
January,	1·25	19·37	2·18	27·01	0·96	33·50	0·50	21·14	1·91	32·58	5·39	56·30
February,	0·82	17·60	1·38	26·62	1·85	34·10	0·48	26·11	2·04	35·16	3·97	58·02
March,	1·14	25·68	2·86	35·40	0·70	43·40	1·55	34·50	3·32	45·04	4·93	64·33
April,	1·21	37·03	2·92	46·26	5·33	54·50	2·68	47·13	3·06	57·06	4·44	69·40
May,	2·32	47·47	2·73	56·02	9·25	63·50	6·57	58·81	4·18	66·32	4·26	75·00
June,	2·81	57·31	3·91	65·62	4·53	71·10	4·36	68·51	5·07	74·11	5·16	81·34
July,	3·20	64·55	3·20	69·71	4·10	76·30	5·07	73·56	3·67	78·00	6·32	83·23
August,	2·87	64·05	2·78	67·47	4·25	73·70	2·62	72·33	4·14	76·46	6·52	83·06
September,	2·97	55·08	3·31	60·05	1·19	65·50	1·83	64·42	2·88	67·74	4·05	79·58
October,	2·12	45·17	2·04	47·69	4·06	53·00	0·88	49·56	2·76	55·68	3·62	70·25
November,	1·92	34·30	2·06	38·26	6·01	42·30	1·11	34·07	2·38	43·15	4·48	62·20
December,	1·24	23·12	1·30	26·88	4·10	33·80	0·33	21·87	2·42	33·31	4·33	55·43
1st Quarter,	3·21	20·88	6·42	29·67	3·51	36·66	2·53	27·25	7·27	37·59	14·29	59·55
2nd ,,	6·34	47·27	9·56	55·96	19·11	63·03	13·61	58·15	12·31	65·83	13·86	75·18
3rd ,,	9·04	61·22	8·69	69·07	9·54	71·83	9·52	70·10	10·69	74·07	16·89	81·95
4th ,,	5·28	34·19	5·40	37·61	14·17	43·03	2·32	35·17	7·56	44·21	12·43	62·62
Totals and Means,	23·87	40·89	30·07	47·24	46·33	53·72	27·98	47·67	37·83	55·42	57·47	69·82

	Southern Plateau—Arizona and New Mexico.				Pacific Coast.					
	Fort Buchanan, Arizona, 31° 40′ N. lat. 111°30′ W. lo. alt. 5350 ft.		Fort Fillmore, New Mexico, 32° 13′ N. lat. 106°42′ W. lo. alt. 3937 ft.		Fort Vancouver, Oregon, 46° N. lat. alt. 50 feet.		San Francisco, California, 37° 48′ N. lat. 122° 26′ W. lo. alt. 150 feet.		San Diego, California, 32° 42′ N. lat 117° 14′ W. lo. alt. 150 feet.	
	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.	Rainfall in inches.	Mean Temperature.
		°		°		°		°		°
January, ...	1·97	39·0	0·01	44·47	9·62	40·56	3·23	49·60	0·83	51·90
February, ...	0·51	45·0	0·10	48·93	3·38	41·66	3·31	51·78	2·01	53 97
March, ...	0·29	47·0	0·21	55·46	3·79	44·14	4·61	52·87	1·40	56·00
April, ...	1·46	62·0	0·20	64 39	2·74	52·55	3·72	55·37	0·77	61 23
May, ...	0·00	68·0	0·34	71·32	2·75	58·95	0·48	58·29	0·57	62·67
June, ...	0·48	74·0	0·54	80·92	2·68	62·67	0·02	56·86	0·15	67·39
July, ...	3·21	75·0	2·50	83·36	2·85	68·71	0·00	57·90	0·01	72·18
August, ...	3·50	73·0	1·40	79·68	0·70	65·56	0·01	57·22	0·39	73·68
September, ...	1·32	70·0	1·26	77·21	0·99	60·81	0·09	58·26	0·03	70·66
October, ...	0·60	65·0	0·54	64·39	2·55	53·30	0·84	57 91	0·05	65·50
November, ...	0·16	45·0	1·50	51·22	6·76	46·51	2·44	54·31	1·16	56 92
December, ...	2·58	39·0	0·63	46·45	6·69	36·51	4·84	51·20	3·06	51·70
1st Quarter, ...	2·77	43·6	0·32	49·62	16·79	42·12	11·15	51·41	4·24	53·96
2nd ,, ...	1·94	68·0	1·08	75·54	8·17	58·06	4·22	55·84	1·49	63·76
3rd ,, ...	8·03	72·6	5·16	80·08	4·54	65·02	0·10	57·79	0·43	72·17
4th ,, ...	3·34	49·6	2·67	54·02	16·00	45·44	8·12	54·47	4·27	58·04
Totals and Means, . .	16·08	58·4	9·23	63·98	45·50	52·66	23·59	54·88	10·43	61·98

The general distribution of rainfall in the United States is thus described by Blodget: "For much the larger area of the United States, and for all portions east of the Rocky Mountains, the distinguishing feature of the distribution of the rainfall is its symmetry and uniformity in amount in large areas. The quantity has rarely or never any positive relation to the configuration of the surface, which would identify it with Europe and the North Pacific coasts; and, in contrast with these, it has a diminished quantity at greater altitudes generally, and the largest amounts in the districts near the sea-level. It also differs from these districts, and from larger land areas generally, in having a larger amount in the interior than on the coast for the same latitude, at least as far north as latitude 42°. The rainiest districts are Florida, the low flats of the Mississippi, then along the course of its valley, then, in Iowa, that remarkable depression at the head of the river; and the least quantities in the Alleghanies, especially their highest parts, and high ground of the Missouri district."

The Northern States of New England, the Lake Region, the States of Minnesota, Dakota, Montana, and the Territory of Washington contiguous to Canada, have a mean temperature under the freezing-point for three or four months of the year. At Fort Snelling, in Minnesota, situated as far south as the 44th degree, the mean winter temperature is as low as 17° F. The summer temperature, on the other hand, throughout the whole of this northern section, is comparatively high, the mean temperature of the third quarter being everywhere above 60° F. The thermometer occasionally rises in a district so far north as Connecticut to 90° F., for days together, during the summer. The Northern States thus exhibit a thermal curve of great amplitude.

The Southern Atlantic and Gulf States have a winter temperature, varying, according to latitude, from 50 to 65° F., and a mean temperature in the third quarter above 80° F. The whole of this region is characterised by mild winters and springs, and exceedingly warm summers and autumns.

The Pacific coast, for corresponding latitudes, has a more equable temperature than that of the east. The Central Valley exhibits great varieties of temperature according to latitude and altitude. On the elevated table-lands of the west, the climate differs from that of the rest of the country—being remarkably dry and liable to great diurnal and annual fluctuations.

Vital Statistics.—The mean annual birth-rate of the United States, according to the Census Returns of 1880, was 31·4 per 1000 of the population; but this is under the true figure, which is estimated at 36 per 1000. The birth-rate of the coloured population is higher than that of the white population in the proportion of 38·6 : 32·0.

The death-rate of the United States, according to the returns, was 15·09 per 1000 of the living population at the date of the census. The death-rate of each State, as so ascertained, will be found in the table showing the distribution of malarial fever in the various States. But the figures there given cannot be taken as accurate, since it is certain that a very considerable proportion of the deaths occurring during the census year was not recorded; and another source of error arises from the calculations being based, not on the mean population of the year, but on the number of survivors at the end of the year. Billings, on a careful consideration of all the data, concludes that the average annual mortality for the whole country was 18 per 1000 during the census year. This estimate is, at least, approximately correct.

The returns showed a male death-rate of 15·35 and a female death-rate of 14·81 per 1000. Billings considers that the proportion of female to male deaths is probably greater than these figures would indicate. The number of deaths under one year to

100 deaths at all ages was 23·24, as against 25·48 in England and Wales for the same year, 1880.

As regards the influence of race, as distinguished by colour, we find that while the recorded death-rate of the white population was 14·74, that of the coloured was 17·28. As the deficiencies in the enumerators' returns are greater for the coloured than for the white population, the difference between the mortality rates of the two races is greater than that indicated by these ratios. The main cause of the excess of mortality in the coloured race is the high rate of infantile mortality which obtains among the coloured population. In the rural districts the mortality among the negro population is not excessive; "it is in cities and towns where the negro is brought into close contact with the evils and vices of civilisation that he dies so rapidly."

From the data collected relating to the Indians on reservations, their death-rate was found to be 23·6 per 1000; but it is estimated that the death-rate among them is probably not far from 30 per 1000.

The monthly distribution of deaths per 1000 total deaths for thirty-one large cities was as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
80·25	79·92	84·39	87·63	87·73	78·64	105·77	89·06	76·74	73·94	75·47	80·38

"The high mortality in the summer months is due mainly to deaths occurring among infants from diarrhœal affections."

The period of maximum mortality varies considerably, as may be supposed, in the different regions. As a rule, however, the excess of deaths takes place in the third quarter. The following table shows the quarterly percentage of deaths for the State of Massachusetts (excluding Boston), and for various cities, coast and inland, from north to south, and of San Francisco on the Pacific coast:—

LOCALITY.	QUARTERS.			
	1st.	2nd.	3rd.	4th.
Massachusetts (excl. Boston), .	26·03	25·41	26·14	22·37
Boston, ...	26·71	22·85	25·82	24·62
New York, ...	24·06	26·34	26·57	23·01
Philadelphia, ...	25·39	25·40	27·52	21·68
Baltimore, ...	22·62	26·47	27·26	23·65
Charleston, S.C., . . .	21·95	25·74	29·18	23·13
Cincinnati, ...	22·26	26·84	27·86	23·03
Louisville, Kentucky, . .	23·20	30·77	25·93	20·09
New Orleans, ...	24·08	27·99	22·39	25·54
San Francisco, ...	26·13	25·80	23·59	24·46

PATHOLOGY.—*Malaria.*—Malarial fevers, including under this term the intermittent, remittent, bilious, and congestive forms, are widely prevalent in the United States. In 1880, malarial fevers caused 2673 out of every 100,000 deaths from all causes. This is a high proportion compared to that observed in most countries of Europe. In 1870, the proportion was slightly less, viz. 2374 per 100,000, which, however, was considerably under that of 1860, when the proportion was as high as 3976 per 100,000.

While malaria is thus an important element in the pathology of the Union, the different States and regions suffer very unequally. The following tables present, as will be seen, a general view of the incidence of malaria throughout the Union, and its prevalence in each individual State. The States are arranged in groups from north to south, and from east to west:—

TABLES SHOWING THE POPULATION OF EACH STATE AND TERRITORY OF THE UNION IN 1880, THE DEATH-RATES, AND THE PROPORTION OF DEATHS FROM MALARIAL FEVER TO 1000 DEATHS FROM ALL CAUSES.

EASTERN REGION, NORTH TO SOUTH.

Name of State.	Population.	Total Deaths.	Rate per 1000.	Proportion of Deaths from Malarial Fever to 1000 Deaths from all causes.
A				
Maine,	648,936	9,523	14·6	2·8
New Hampshire,	346,991	5,584	16·1	3·0
Vermont,	332,286	5,024	15·1	5·9
Massachusetts,	1,783,085	33,149	18·6	2·3
Rhode Island,	276,531	4,702	17·0	0·8
Connecticut,	622,700	9,179	14·7	24·4
New York,	5,082,871	88,332	17·3	11·4
B				
New Jersey,	1,131,116	18,474	16·3	17·6
Pennsylvania,	4,282,891	63,881	14·9	6·3
Delaware,	146,608	2,212	15·1	15·8
Maryland,	934,943	16,919	18·1	15·3
District of Columbia,	177,624	4,192	23·6	19·8
Virginia,	1,512,565	24,681	16·3	23·7
West Virginia,	618,457	7,418	12·0	6·6
C				
North Carolina,	1,399,750	21,547	15·4	44·6
South Carolina,	995,577	15,728	15·8	46·4
Georgia,	1,542,180	21,549	13·9	49·1
Florida,	269,493	3,159	11·7	95·2

TABLES SHOWING THE POPULATION, ETC.—*continued.*

CENTRAL REGION, NORTH TO SOUTH.

Name of State.	Population.	Total Deaths.	Rate per 1000.	Proportion of Deaths from Malarial Fever to 1000 Deaths from all causes.
D				
Michigan, . . .	1,636,937	19,743	12·1	16·2
Wisconsin, . . .	1,315,497	16,011	12·1	8·4
E				
Ohio, ...	3,198,062	42,610	13·3	12·8
Indiana, ...	1,978,301	31,213	15·7	29·8
Illinois, ...	3,077,871	45,017	14·6	24·7
Kentucky, . . .	1,648,690	23,718	14·3	31·1
Tennessee, . . .	1,542,359	25,919	16·8	35·3
F				
Iowa, ...	1,624,615	19,377	11·9	22·3
Missouri, ...	2,168,380	36,615	16·9	49·1
Arkansas, ...	802,525	14,813	18·4	75·8
G				
Alabama, . . .	1,262,505	17,929	14·2	73·4
Mississippi, . . .	1,131,597	14,583	12·9	70·5
Louisiana, . . .	939,946	14,514	15·4	59·8
Texas, ...	1,591,749	24,735	15·5	60·2

WEST CENTRAL REGION, NORTH TO SOUTH.

Name of State.	Population.	Total Deaths.	Rate per 1000.	Proportion of Deaths from Malarial Fever to 1000 Deaths from all causes.
H				
Minnesota, . . .	780,773	9,037	11·5	3·6
Dakota, ...	135,177	1,304	9·6	13·0
Nebraska, . . .	452,402	5,930	13·1	17·0
Kansas, ...	996,096	15,160	15·2	47·6
I				
Montana, ...	39,159	336	8·6	23·8
Wyoming, . . .	20,789	189	9·1	31·7
Idaho Territory, . .	32,610	323	9·9	15·4
Colorado, ...	194,327	2,547	13·11	11·3
Utah Territory, . .	143,963	2,414	16·7	4·9
New Mexico Territory, .	119,565	2,436	20·3	59·5
Arizona Territory, . .	40,440	291	7·20	20·6

TABLES SHOWING THE POPULATION, ETC.—*continued.*

WESTERN PACIFIC REGION, NORTH TO SOUTH.

Name of State.	Population.	Total Deaths.	Rate per 1000.	Proportion of Deaths from Malarial Fever to 1000 Deaths from all causes.
Washington Territory, .	75,116	755	10·0	10·6
Oregon, ...	174,768	1,864	10·7	16·6
Nevada, ...	62,266	728	11·7	5·5
California, . . .	864,694	11,530	13·3	13·7

By comparing the proportion of deaths from malarial fever with the deaths per 1000 from all causes in groups A, B, C, situated along the Atlantic coast, it will be seen that malarial fever increases in intensity as we approach the south. This geographical relation is also observed in respect to the other groups along the Central Valley, the West Central, and Pacific coast regions. Such exceptions as occur are doubtless to be explained by special local conditions of the soil. The high proportion of deaths in Connecticut is the result of the epidemy then prevailing there, to which we shall have again to refer. The low fever mortality of Pennsylvania and West Virginia, as compared with the adjacent coast States, is owing in great part to their position in relation to the Alleghany range facilitating natural drainage, and at the same time securing to them the advantage of altitude, which here means not only a reduced temperature, but, as we have pointed out, a scantier rainfall.

In the subjoined table the country is divided into the twenty-one grand natural divisions already described, having reference to the geographical or physical characters of the country, and exhibits the distribution of malarial deaths in each of these—distinguishing also the proportions in country and town districts; in the white and coloured races, and the inhabitants of Irish and German parentage :—

TABLE SHOWING FOR RURAL AND CITY, WITH DISTINCTION OF SEX, AND FOR WHITE AND COLOURED, IRISH AND GERMAN PARENTAGE, THE PROPORTION OF DEATHS FROM MALARIAL FEVER IN 1000 DEATHS FROM KNOWN CAUSES IN THE UNITED STATES.

GRAND GROUPS.	RURAL.		CITIES.		White.	Coloured.	Irish Parentage.	German Parentage.
	Male.	Female.	Male.	Female.				
1. North Atlantic Coast Region,	5·8	4·9	2·9	3·1	...	...	3·5	6·2
2. Middle Atlantic Coast Region,	26·3	27·1	13·1	14·0	16·8	22·1	16·2	12·9
3. South Atlantic Coast Region,	73·7	67·5	11·9	11·1	82·8	50·9	...	...
4. Gulf Coast Region,	75·9	81·2	51·2	36·8	72·0	58·7	...	...
5. North-Eastern Hills and Plateaus,	7·2	7·1	10·6	13·3	...	...	10·1	5·2
6. Central Appalachian Region,	10·1	11·5	13·6	13·4	...	...	12·2	7·2
7. Region of the Great Northern Lakes,	12·6	9·9	8·1	8·3	...	...	9·8	6·5
8. The Interior Plateau,	18·0	18·3	4·3	3·9	11·0	29·5	9·0	5·8
9. Southern Central Appalachian Region,	27·3	23·1	...	...	23·3	24·1	...	...
10. The Ohio River Belt,	19·0	23·4	8·4	9·7	18·2	16·5	11·6	13·3
11. Southern Interior Plateau,	69·6	69·1	...	...	71·4	67·9	...	...
12. Southern Mississippi Belt,	83·5	87·7	...	...	84·0	86·7	...	...
13. Northern Mississippi River Belt,	39·9	40·0	23·1	25·0	...	...	28·9	32·4
14. South-West Central Region,	69·3	73·2	...	...	72·6	65·8	...	...
15. Central Region, Plains and Prairies,	28·2	29·0	24·8	30·6	29·1	25·1	...	...
16. The Prairie Region,	28·7	29·7	...	...	...	...	23·4	18·0
17. Missouri River Belt,	40·9	46·0	79·1	88·2	...	...	53·7	33·5
18. Region of the Western Plains,	23·4	23·1	3·4	16·5	...	...	26·0	63·4
19. Heavily-timbered Region of the North-West,	12·2	16·1	...	...	...	...	17·1	7·4
20. Cordilleran Region,	27·8	29·3	...	...	...	...	25·4	3·5
21. Pacific Coast Region,	8·3	14·6	4·9	8·0	...	...	5·6	6·2
Total,	32·1	33·4	11·8	11·8	30·7	48·3	12·9	14·1

It is evident, from the above table, that malaria in the States is eminently a disease of the country. For one death from malarial fever occurring in the cities, nearly three take place in the rural districts. It is to be remarked, also, that the negro, in the States, so far from enjoying that immunity from fevers which belongs to his race elsewhere, suffers more than his white fellow-citizen. This is to be accounted for, not by assuming a special liability on the part of the negro to the malarious infection, but by the fact that the coloured population is largely employed in agricultural work in the malarious districts of the south, and are thus more exposed to malarious influences, to which also their circumstances and habits of life render them specially liable. The comparatively low fever death-rate of those of Irish and German parentage is owing to the fact that these nationalites are located in non-malarious regions, and that a larger proportion are of the ages least subject to the infection.

We shall now proceed to examine briefly the influence of (1) temperature; (2) rainfall; (3) altitude; and (4) soil on fever prevalence and mortality in the States.

1. We have already noticed that the ratio of fever deaths to the total mortality augments as we go south. Thus latitudinal distribution of malaria may reasonably be supposed to be in great part related to temperature. Drake[1] gives the following table, exhibiting the ratio of admissions for malarial fever per 1000 of the troops at certain stations, which was designed to prove that fever increases or diminishes in proportion as the mean summer temperature of a given locality is high or low.

		North Latitude.	Annual number of cases in 1000 of Mean Strength.	Annual Mean Temperature.	Mean Heat of Winter.	Mean Heat of Spring.	Mean Heat of Summer.	Mean Heat of Autumn.
		° ′		°	°	°	°	°
Along Mississippi River.	Baton Rouge, . .	30·36	824	67·56	52·68	68·72	81·48	67·38
	Jefferson Barracks,	38·28	475	56·93	33·98	56·55	76·19	54·38
	Fort Armstrong, .	41·32	307	50·65	25·15	50·82	74·57	52·07
	Fort Crawford, .	43·03	301	47·37	20·69	48·25	72·38	48·09
	Fort Snelling, .	44·53	62	45·15	17·29	46·56	71·16	45·59
West of Mississippi River.	Fort Gibson, . .	35·48	1435	61·07	42·50	61·26	79·17	61·53
	Fort Leavenworth, .	39·23	629	52·34	27·60	53·38	74·00	54·39
Lakes.	Fort Dearborn, .	41·50	251	46·14	24·31	45·39	67·80	47·09
	Fort Brady, . .	46·30	44	40·62	18·06	37·17	62·14	44·13

While these figures undoubtedly bear witness to the influence of a high summer temperature in increasing the prevalence of malarial fever, they also prove that temperature is not the sole cause of such prevalence. Thus, at Baton Rouge, where the mean heat of summer is higher than that of Fort Gibson, the proportion of fever cases per 1000 is not much more than one half of what occurs at the latter station. Fort Leavenworth, again, has the same summer temperature as Fort Armstrong, but is twice as malarious. Examples of the same kind, showing that the *rôle* of temperature, although important, is, nevertheless, limited by other conditions, will be found in the general table of the deaths from malaria in the different States already given. We find, for example, that Utah has a lethal-rate[1] from fever of 4·9, while New Mexico has one of 59·5. The difference here, evidently, is too great to be accounted for by the difference in temperature.

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[1] Drake, *Diseases of Interior Valley of North America*, Philadelphia 1854.

2. The influence of the annual rainfall on the prevalence of fever is by no means evident. The problem does not present itself in a simple form. We cannot obtain two districts, the one with a scanty, and the other with an abundant rainfall, which in other respects are so nearly alike that they can be profitably compared or contrasted.

If, however, we confine our attention to a single locality, of which we have the fever mortality and rainfall for a series of years, the relation between annual rainfall and annual fever mortality (if such exists) ought to be apparent.

The following table gives the annual rainfall and ratio of deaths from malarial fever per 1000 of the population for New Orleans for the twelve years 1869–1880:—

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Means.
Annual Rainfall,	64·34	69·46	88·12	68·81	78·17	77·46	101·86	72·87	70·71	62·53	51·67	69·86	72·79
Ratio of Fever Deaths, . .	1·79	2·26	1·82	1·52	2·33	2·32	1·82	1·91	1·95	3·68	0·96	1·55	1·99

The year 1879 was at once the driest and healthiest of the series; but the second driest year, viz. 1878, was the most unhealthy. The wettest year was 1875, but the fever death-rate that year was slightly below the mean. These facts show that for New Orleans, at least, there is no constant relation between the annual rainfall and the annual fever mortality.

Let us now inquire whether the seasonal distribution of the rainfall affects, to any marked extent, the period of fever prevalence? It is remarkable that in every one of the stations occupied by the United States Army—stations[2] situated all over the Union, from the extreme north to New Mexico and Texas, and from the one ocean to the other—the maximum of fever admissions for the period 1839–60 everywhere falls on the 3rd quarter, with the exception of that part of the North Atlantic region corresponding with New England, in South Texas, in Utah, and at Fort Buchanan in Arizona.

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[1] By the lethal-rate I mean the proportion which the deaths from a given disease bears to the deaths from all causes. By the death-rate is understood the ratio which deaths from a given disease bears to a unit of the population.

[2] *Statistical Report of Sickness and Mortality in the Army of the United States*, Washington 1860.

In respect to the first of these regions, it is stated that the fevers that occurred in this command were not contracted on the spot; but if we refer to the monthly distribution of deaths from malarial fever in the North Atlantic Coast Region, as given in the Census Report of 1880, it will be seen that, as in the military returns, the period of maximum fever mortality falls on the 2nd quarter, the maximum occurring in the month of May. This and Utah are the only regions in the States where the spring fevers dominate over the autumnal. But, in the north and middle divisions of the States, the 2nd quarter, next to the 3rd, is that most charged with fever admissions. As we advance towards the south, the proportion of admissions in the 2nd quarter diminishes, and those in the 4th quarter increases; but still the third is everywhere that in which fever is most frequent, except in South Texas and at the solitary post of Fort Buchanan. In West Texas, and in New Mexico generally, although the 4th quarter follows close upon the 3rd as regards the prevalence of malarial fevers, the 3rd continues to occupy the first place. In Utah, with its high altitude, and its comparative freedom from malaria, fever, as on the New England coast, is most prevalent in the 2nd quarter. And what is true of malarial fevers as a class is generally true of each of the forms of fever included in the military returns, viz. remittent, intermittent, and congestive fevers.

It will be observed from a reference to the climatological table, that in the States there is no such uniformity in the seasonal distribution of the rainfall as there is in respect to the distribution of the fevers. And this is presumptive evidence that the seasonal evolution of malaria is not controlled by rainfall distribution.

At Fort Columbus (New York) the maximum rainfall is in the 2nd quarter, while on the South Atlantic coast the heaviest rainfall is in the 3rd quarter. At Newport, at Jefferson Barracks, and at Fort Leavenworth, the 2nd quarter is the wettest. At New Orleans the 3rd quarter is rather more rainy than the 2nd; but still we find the 3rd quarter in all these regions to be the one most charged with fever admissions.

So far, then, as these facts go, there is no evidence that the season of heaviest or scantiest rainfall affects the period when malaria attains its maximum.

As regards temperature the case is different, for the 3rd quarter is everywhere that during which the mean temperature is highest, and it is also that when fever, as a rule, is at its maximum. This renders it probable that temperature is not without its influence on the seasonal evolution of malaria in the States.

A more precise idea of the relation of temperature and rainfall to the prevalence of malarial fever is to be derived from a study of the monthly admission or death rates of different localities, with the corresponding monthly mean temperature and rainfall in the same locality. I have obtained data of this nature for only a few places, which are hereunder given :—

CONNECTICUT, 1882.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	ec.
Deaths—												
Malarial Fever, .	5	3	10	9	23	12	12	22	20	7	5	2
Typhoid Fever, .	9	10	13	10	11	12	10	18	26	48	30	25
Rainfall (Waterton Barracks), . .	2·87	28·5	3·30	3·70	3·75	3·61	2·64	4·41	3·00	3·85	3·98	40·1
Temperature, do.	27·23	25·40	33·75	44·98	55·17	64·74	70·60	69·12	61·71	48·84	37·58	29·02

FORT JACKSON AND NEIGHBOURING STATIONS ON THE SAVANNAH RIVER.[1]

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Admissions—												
Intermittent Fever,	130	189	244	194	138	132	254	248	276	205	101	103
Remittent Fever, .	5	9	2	4	2	10	67	134	134	62	22	10
Rainfall (Oglethorpe Barracks), . .	3·57	2·18	7·11	2·91	3·43	4·65	8·79	8·06	4·07	1·95	1·19	3·42
Temperature, . .	54·44	55·05	58·64	67·15	75·46	79·84	81·46	80·81	77·02	67·12	59·67	52·69

MICHIGAN.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average percentage of returns reporting presence of Fevers, ten years 1877–88—												
Intermittent Fever, .	58	60	63	72	78	80	82	81	81	79	70	61
Remittent Fever, .	40	39	41	44	47	48	51	57	60	58	48	42
Typho-Malarial Fever	18	15	14	12	12	12	16	25	40	43	33	22
Rainfall (average of a number of Stations), . . .	2·13	2·54	2·53	2·65	3·41	4·22	3·61	3·58	3·57	3·62	3·23	2·76
Temperature, do.	20·56	23·62	29·80	44·33	56·08	65·10	70·52	68·14	61·67	50·83	36·04	26·60

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[1] The Savannah River divides South Carolina from Georgia.

NEW ORLEANS.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average monthly number of Fever Deaths, 1869–80, .	12·5	11·6	15·3	17·0	21·4	28·4	44·5	66·2	82·0	58·6	30·5	16·9
Monthly percentage of Intermittent Fever Admissions, 1841–49, . .	3·7	3·7	3·8	3·7	3·8	7·0	11·6	12·2	13·0	14·2	13·1	9·4
Remittent Fever Admissions, 1841–49,	1·7	1·2	1·3	1·5	5·0	8·4	17·6	20·7	19·5	14·5	5·8	2·6
Average Rainfall, forty Years, . .	5·39	3·97	4·93	4·44	4·26	5·16	6·32	6·52	4·05	3·62	4·48	4·33
Temperature, mean of forty-two Years,	56·30	58·02	64·33	69·40	75·00	81·34	83·23	83·06	79·58	70·25	62·20	55·43

FORT BUCHANAN, ARIZONA, 1858.

(5000 feet above the sea level.)

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fever Admissions (chiefly intermittent), . . .	9	6	10	4	3	8	23	50	95	139	74	32
Rainfall, . . .	1·97	0·51	0·29	1·46	0·00	0·48	3·21	3·50	1·32	0·60	0·16	2·58
Temperature, . .	39	45	47	62	68	74	75	73	70	65	45	39

It appears from these figures that the intermittent type of fever attains its maximum in Connecticut in May (fever here being chiefly of the intermittent type); in Michigan in July; at Fort Jackson in September, and at New Orleans and Fort Buchanan in October. In Connecticut and Michigan the maximum coincides with a pretty heavy rainfall; at Fort Jackson, with a moderately high but diminishing rainfall; at New Orleans, with a minimum rainfall; and in Arizona, with dry weather two months after the heavy rains. In Connecticut there are two distinct maxima for intermittent fever; the principal, or spring one, coincides with a moderate but increasing temperature (55°·17); the second, in autumn, with a high but slightly falling temperature of 69°·12. At Fort Jackson and New Orleans the maximum corresponds to a high but decreasing temperature (77°–79° F.), and at Arizona with a moderate but rapidly falling temperature (65°). As regards the remittent type, it will be observed that at New Orleans and Fort Jackson the admissions are almost confined to the hot season, the maximum falling on August and September, after a period of continued high temperature, and as the thermometer is beginning to fall. At New Orleans the actual maxima of remittent fever and rainfall coincide; and at Fort Jackson the maximum of remittent fever occurs during the period of heavy rains. In Michigan the maximum prevalence of remittent fever falls on the three months, August, September, and October, with a moderately high but falling temperature. But whereas remittent fever is extremely rare indeed during the colder season at Fort Jackson and New Orleans, it persists during the winter to a very considerable extent in Michigan. The reason of this difference is by no means obvious. We may also remark that typho-malarial fever, in Michigan and Connecticut, attains its maximum in autumn; and, as bearing upon the etiology of typho-malarial fever, it may be observed in passing that typhoid and typho-malarial fevers attain their maximum at the same time in Michigan, Connecticut, and Alabama. The conclusions I draw from the facts are—1st. No constant relation exists between the period of rainfall and that at which either intermittent or remittent fevers attain their maximum. 2nd. Intermittent fever is chiefly vernal in New England, but with an autumnal rise, which becomes more marked during epidemic periods. This holds good, too, of the dry elevated table-land of Utah. In most other parts of the country malarial fever is autumnal, following the prolonged heats of summer. 3rd. The period of maximum fever prevalence becomes retarded in proportion as we proceed from north to south and descend from higher to lower altitudes. 4th. In the south, remittent fevers are practically confined to the warm months. 5th. Remittent fever, in the Northern States, maintains its footing during the months when the temperature is under the freezing-point, which suggests a doubt whether the cold-weather remittent fever of the north is of the same nature, in all respects, as the warm-weather fever of the south. 6th. Typho-malarial and typhoid fevers appear to be under similar laws as regards their period of evolution.

We have hitherto been considering the influence of rainfall and temperature on the seasonal evolution of malarious fevers, with special reference to the question, how far one or other of these elements determine the normal period of the year at which the different forms of malarial fever occur in different geographical regions of America. We have still to examine to what extent these meteorological conditions affect the intensity and the precise period of prevalence of malaria in a given region in individual years. For this purpose we give the following tables:—Table No. I. gives the number of deaths from malarial fever in New Orleans for the twelve years 1869–80, and the monthly rainfall for the same period. Table No. II. gives the deaths for the eight years 1873–80, with the monthly temperature. The data for the temperature of the years 1869–72 are wanting.

TABLE I.—NEW ORLEANS.—MONTHLY RAINFALL AND DEATHS FROM MALARIAL FEVER.

Months.	1869.		1870.		1871.		1872.		1873.		1874.		1875.		1876.		1877.		1878.		1879.		1880.		Means.	
	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.	Fever Deaths.
January,	...	13	9·46	15	13·52	7	5·22	15	5·61	17	2·30	11	9·17	10	5·47	15	8·20	22	5·36	10	2·34	5	1·02	10	6·15	12·5
February,	...	8	3·61	9	1·29	11	5·91	20	2·20	14	3·70	12	16·22	8	9·33	14	0·85	20	3·50	7	2·13	3	4·62	13	4·34	11·6
March,	13·90	13	2·85	20	6·11	15	9·73	20	5·49	20	7·31	12	13·73	14	11·65	13	5·31	12	4·63	16	1·36	11	6·66	18	7·39	15·3
April,	4·47	16	9·22	20	2·75	15	6·73	14	1·73	17	18·44	16	10·44	19	8·20	19	4·51	23	1·51	23	9·56	8	6·88	14	7·03	17·0
May,	1·10	22	4·41	31	5·72	11	3·97	31	21·50	30	0·04	24	3·19	15	8·54	20	1·14	18	6·14	16	4·63	13	6·58	26	5·58	21·4
June,	9·88	19	4·09	50	9·96	35	5·78	18	8·58	25	11·97	24	6·22	26	7·19	23	2·30	47	7·12	26	2·96	16	6·43	32	6·87	28·4
July,	4·64	47	6·08	43	6·43	40	7·03	34	6·75	62	17·37	67	8·19	39	5·19	55	7·07	41	5·26	47	7·03	33	11·22	26	7·68	44·5
August,	8·73	60	11·58	46	8·63	64	3·95	46	10·83	55	5·92	125	11·32	63	5·55	38	3·27	61	4·90	177	10·44	30	4·60	30	7·47	66·2
September,	8·19	61	1·64	90	6·88	65	2·36	38	4·46	91	5·08	50	8·54	100	0·39	83	16·29	79	2·67	229	2·67	19	7·48	79	5·55	82·0
October,	5·09	35	1·85	48	15·65	45	3·38	32	1·80	79	...	79	2·26	55	0·10	56	9·62	40	7·07	163	1·36	32	1·88	39	4·55	58·6
November,	5·21	27	5·15	46	9·04	26	9·06	11	7·35	25	1·76	36	6·86	18	2·97	41	6·20	29	7·78	55	4·29	20	6·04	32	5·97	30·5
December,	3·13	21	9·52	17	2·14	14	5·69	12	1·85	11	3·57	32	5·72	16	8·29	24	5·95	17	8·59	8	2·88	12	6·45	19	5·31	16·9
Totals,	64·34	342	69·46	435	88·12	348	68·81	291	78·17	446	77·46	488	101·86	383	72·87	401	70·71	409	62·53	773	51·67	202	69·86	336	73·89	40·4
Ratio of Fever Deaths per 1000,		1·79		2·26		1·82		1·52		2·33		2·32		1·82		1·91		1·95		3·68		0·96		1·55		1·99

TABLE II.—NEW ORLEANS.—MONTHLY TEMPERATURE AND DEATHS FROM MALARIAL FEVER.

Months.	1873.		1874.		1875.		1876.		1877.		1878.		1879.		1880.		Means.	
	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.	Temperature.	Fever Deaths.
January, ...	49·88	17	56·71	11	53·89	10	61·15	15	53·08	22	51·08	10	52·90	5	63·00	10	55·21	12·5
February, . . .	60·12	14	59·59	12	55·23	8	60·00	14	55·93	20	55·50	7	55·40	3	59·08	13	57·60	11·6
March, ...	61·37	20	67·81	12	64·10	14	60·42	13	60·64	12	66·36	16	64·30	11	65·50	18	63·81	15·3
April, ...	67·95	17	66·22	16	65·32	19	69·66	19	67·56	23	71·41	23	67·00	8	71·20	14	68·29	17·0
May, ...	75·19	30	76·91	24	77·42	15	72·20	20	73·53	18	75·54	16	74·80	13	75·50	26	75·13	21·4
June, ...	81·66	25	82·62	24	80·29	26	81·60	23	78·13	47	81·95	26	79·00	16	80·30	32	80·76	28·4
July, ...	83·57	62	86·33	67	83·09	39	80·85	55	81·71	41	83·83	47	81·80	33	82·60	26	82·97	44·5
August, ...	82·28	55	85·02	125	80·14	63	79·51	38	83·29	61	83·59	177	79·30	30	81·50	30	81·82	66·2
September, . . .	79·56	91	80·41	50	77·21	100	75·30	83	78·44	79	78·75	229	77·20	19	77·00	79	77·98	82·0
October, ...	68·21	79	70·94	79	68·15	55	64·13	56	70·49	40	71·42	163	71·50	32	68·00	39	69·23	58·6
November, . . .	61·46	25	64·10	36	66·44	18	55·90	41	58·41	29	59·46	55	64·10	20	56·00	32	60·73	30·5
December, . . .	56·92	11	59·48	32	62·62	16	45·80	24	56·77	17	50·85	8	59·50	12	53·10	19	55·63	16·9
Totals, ...	69·14	446	70·99	488	69·57	383	67·21	401	68·16	409	69·14	773	68·15	202	69·05	336	69·1	404
Ratio of Fever Deaths per 1000, ...		2·33		2·32		1·82		1·91		1·95		3·68		0·96		1·55		1·99

It will be observed that the months of June, July, and August of 1874 were characterised by a temperature considerably above the mean, and that June and July were also months of excessive rainfall. The fever deaths in July and August were also very much above the average. It was in August, however, when the rains had become scanty, and while the temperature still remained very high, that the deaths rose to nearly double the average.

The fever mortality in August, September, October, and November 1878 was excessively high. The rainfall during that year was very scanty, but the temperature was above the normal. Were the drought and high temperature the cause of the excessive fever mortality? This is not improbable; but we observe that fever had already begun to be unusually prevalent in March and April of that year (which were unusually dry and hot months), just as we have pointed out in India, that an excessive autumnal fever death-rate is heralded by a rise in the mortality in the earlier months of the year. The year 1876, with a temperature and rainfall below the mean, had a low fever death-rate.

In the years 1870 and 1873, maximum, or very heavy rains occurred in August, with a sudden supervention of dry weather in September, during which fevers attained their maximum. Had the heavy rains in August, followed by dry weather in September, anything to do with the great increase in the fever deaths observed in that month? Or is it only that August is usually the rainiest month in New Orleans, and September the most feverish month? In 1872, and again in 1874, when the heavy rains occurred in July, and the month of August was dry, the maximum of fever deaths took place in August instead of September, as is the rule in New Orleans; which appears to show that when the heavy rains anticipate, and the drought sets in early, the fever period also anticipates. On the other hand, as showing that drought succeeding heavy rains is not an essential element in determining the period of the fever maximum, we have to look at what happened in 1877, when the maximum of rainfall and that of fever deaths occurred together in September. The maximum rainfall is only once postponed to October (1871); this was followed by heavy November rains, and no unusual fever mortality followed; from which we infer that late rains do not affect the prevalence of fever.

So far as one can judge from the limited data at our disposal, it would appear that very high temperatures coinciding with dry weather tend to increase the mortality from malarial fever in New Orleans. If the heavy rains occur in July, and the weather in August becomes dry, the fever deaths will probably attain their maximum in August instead of September, especially if the temperature is unusually high.

3. Fever is met with in the States at high elevations. We shall presently return to the subject of the so-called *mountain fever;* but restricting ourselves to typical intermittent fever, respecting the nature of which there can be no question, we find that it occurs at Fort Buchanan, at a height of 5330 feet. Fort Thorn, lat. 32° 46′, at an altitude of 4500 feet, proved so malarious that it had to be abandoned. Fevers are also met with in Washington Territory, in 46° 14′, at an elevation of 3000 feet. It has to be noticed, that the local conditions at Forts Buchanan and Thorn are highly favourable to the development of malaria. In a malarious country malarial fevers will develop at any altitude at which the summer temperature reaches 60° F., if marshy conditions prevail.

The fevers met with at these high altitudes are usually of the intermittent type, and are less grave than those that are met with in lower and consequently warmer localities.

4. The conditions of soil favouring the prevalence of malaria in the United States may be arranged in two classes—(1) the exposure and disturbance of virgin soil by the cutting down of forests or undergrowth; (2) the excess of moisture in the soil.

Without suggesting that the nature of the infection is different in the two cases, we have to recognise (*A*) a clearing miasm and (*B*) a marsh miasm.

(*A*) On no point is there greater unanimity than on this, that the first breaking up of virgin soil, whether prairie or forest land, is followed by an increase of malaria, which subsequently diminishes as cultivation is continued.

The severity of malaria in New England, when the first settlements were started, is proved by the interesting fact mentioned by Dr. Adams (*Massachusetts Health Report,* 1880), that at the first settlement of that State, people built their houses on the hill tops, to avoid the malaria of the valleys; but as the cultivation went on, the disease seemed entirely to disappear.

No less clear is the statement of Rush as to Pennsylvania: "It is a well-known fact," he says, "that intermittent and bilious fevers have increased in Pennsylvania in proportion as the country has been cleared of its wood in many parts of the State. It is equally certain that these fevers have lessened or disappeared in proportion as the country has been cultivated." An instance is recorded in the *Connecticut Board of Health Report,* 1882, in which a tract of land, probably never before disturbed, was ploughed. Later in the season, several families, living south and east from the said land, had chills and fever of a severe form (page 152).

Hirsch refers to a similar case, but on a larger scale, as occurring in Bradford County, Pennsylvania, in which an increase of malaria followed the reclaiming of a large tract of land.

The comparative liability of the miners in California to contract fever, notwithstanding the healthiness of the climate, may be accounted for, partly by the disturbance of the soil, and partly by the action of the water used in connection with the working of the ores.[1] At the present day, the distribution of malaria over the new States and Territories of the West is materially regulated by the extension of clearing and cultivation. In certain of these districts the evils arising from the clearings are augmented by the marshy nature of the soil.

The cutting down of undergrowth covering swampy ground, by exposing the moist soil to the action of sun and air, may apparently prove dangerous, even when the soil itself is not disturbed. We find an illustration of this in the following account from the Statistical Report of the United States Army:—

"Fort King in Florida (lat. 29° 12′ N., and long. 82° 12′ W.) is built on a loose sandy soil containing vegetable mould, with an argillaceous substratum, surrounded, at the distance of 500 yards from the pickets, by rich marshy bottoms." In 1834, the troops stationed there suffered from violent forms of remittent and intermittent fevers; and this outbreak was ascribed to the cutting down of the smaller trees and undergrowth of a neighbouring marsh, as a precaution against an Indian ambuscade.

(*B*) The distribution of malarial fever in the States is largely determined by the greater or lesser amount of moisture in the soil of the different districts, whether arising from (*a*) irrigation; (*b*) inundations; (*c*) the low-lying position of the land; (*d*) marshes and swamps; or (*e*) artificial marshes.

(*a*) The prevalence of the disease in Georgia and the Carolinas is ascribed to the wet culture of rice. The dry culture is found to be less unhealthy. The extreme unhealthiness of the Oglethorpe Barracks, during the period when they were situated one mile south of the city of Savannah, was attributed to their being surrounded by rice fields and marshes. In 1828, during the months of July, August, and September, twenty-three deaths occurred in these barracks in a command of ninety-five men; and during the months of October, November, and December, eighteen deaths in a command of eighty-five men.

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[1] Logan, *Trans. Amer. Med. Assoc.* 1859, p. xii., quoted by Hirsch.

Hirsch mentions Daniell and Simons' observations, to the effect that malaria had become endemic in some parts of Georgia, and round Charleston, and at other places where rice fields were laid out.[1]

Since the close of the Civil War, large areas of land in the delta of the Mississippi, above and below New Orleans, have been devoted to rice culture, and the result is stated to be an increase in the fevers, attended with hæmorrhage from the stomach, bowels, or kidneys, vomiting of black matter, and jaundice, which have been mistaken for yellow fever.

In 1880, the rains of the spring and early portion of the summer deluged the rice fields and swamps of the delta with water. "The several types of the remittent, intermittent, and congestive fevers appeared to be due to the preceding causes, and especially to the drying-up of the stagnant waters of the rice fields" (*Louisiana Board of Health Report*, 1880).

(*b*) Large tracts in many of the States are subject to inundations, and fever presses with considerable severity upon these districts.

The lower reaches of the Mississippi are so much flooded after the rainy season, that stretches of country, varying from 30 to 100 miles wide, are covered with water. For nearly 400 miles from its mouth, much of the country through which this river flows is swampy, "the habitat of alligators, and subject to epidemic and other diseases inimical to human life." As we ascend to the mouth of the Missouri, we find, according to Drake, annual floods leaving small ponds, swamps, and lagoons, which in the aggregate are of great extent, and but partially dried up before the next inundation. But it is not the larger rivers alone that are subject to overflow; many of the smaller rivers of Florida, Alabama, Louisiana, and Texas, and other States, cause inundations. The very regularity and extent of these inundations render it difficult to estimate their effect in the causation of endemic fever; for all inundations are not followed by fever. We even read of inundations that have been followed by improved health. In 1881, for example, a great overflow from the lakes, in the month of February, inundated a part of New Orleans, rendering thousands of people homeless, and destroying much property; but it was not followed by any increase in malaria; it seemed rather to improve the public health. It may be doubted whether it would have been equally harmless if it had occurred in July or August. The effect of any particular flood will depend upon the nature of the soil, its drainage, the altitude of the locality, and the season of the year when it takes place. Instances are not wanting of the noxious influence of particular inundations on health. An unprecedented rise of the Nueces River caused an inundation of the country surrounding Fort Merrill, Texas. We are told that the subsidence of the waters was followed by an increase of sickness in the end of June and in July. In August every individual belonging to the garrison had suffered from fever, so much so that there were not enough men to do ordinary garrison duty.

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[1] Hirsch, *Op. cit.* vol. i. p. 270.

Fort Thorn, in New Mexico, on the Rio Grande, had to be abandoned on account of its unhealthiness, which was ascribed to the neighbourhood of extensive marshes, and to inundations of the neighbouring lands.

Whatever may be the precise influence of inundations, properly so called, it is very evident that malaria is more prevalent and intense in the low-lying, moist lands, than in those that are better drained.

(*c*) The vast alluvial level belt stretching along the Atlantic coast from Virginia to Florida, traversed by numerous rivers and streams, imperfectly drained, and with a highly humid, and, in many places, a swampy soil, is highly malarious. Westward, and to the north of this belt, the land rises towards the Alleghanies, with its elevated table-lands and ridges. Many parts of this region are entirely free from malaria, and, taking it as a whole, it is healthy compared with the maritime districts. In the same way, the hilly parts of Alabama and Mississippi contrast favourably, as regards their freedom from fevers, with the low districts liable to overflow. The pine woods growing on the sand dunes, and stretching along the borders of the Gulf of Mexico from Pontchartrain in Louisiana to Pensacola in Florida, probably owe their salubrity to the comparative dryness of the soil on which they grow.

It is doubtless to the excess of moisture in the soil that we are to ascribe the prevalence of fever along the banks or beds of rivers, and the margins of lakes. Drake says that "in North Alabama, Tennessee, and Kentucky, swamps are almost unknown, except along the few rivers which have wide bottom lands, most of which, moreover, are exempt from inundations. The rivers, however, are sinuous, and in summer sluggish and pondy, and it is in their vicinity that autumnal fevers prevail."

"In the States of Illinois, Indiana, and Ohio, the rivers generally flow through wide valleys, many of which are liable to be overflowed; small lakes, ponds, and swamps are also frequent in certain portions of these States, and it is precisely these localities which are most infected. To the east of all the States mentioned, as we climb the mountains, the surface water is no longer found in basins, and the streams generally have a rapid current down narrow and rocky channels, and here autumnal fevers nearly disappear, or, when present, are confined to the valley of some stagnating stream" (Drake).

It has been observed at Jefferson Barracks, situated on the right bank of the Mississippi, that while the troops stationed there near the river were suffering from fever, persons living at the distance of one mile, and having a screen of trees between them and the river, suffered little from fever, and such cases as occurred were of a milder nature than those in the barracks. In regions comparatively little subject to the disease, it is only along the course of the rivers that it is met with. In California, malaria is specially prevalent along the Sacramento and San Joaquin Rivers; in Arizona, along the Rio Colorado; in New Mexico, on the banks of the Rio Grande.

(*d*) Swamps and marshes, whether along the course of rivers or otherwise formed, are generally unhealthy in the States. This is the case as regards the Yazzo Swamp, near Memphis, in the State of Mississippi; the swamps in the Bay of Mobile in Alabama; those along the coasts, especially the Gulf coast of Florida; the marshy shores of Lake Okeechobee in the interior; the Okefinokee Swamp in Georgia, and many others. On the other hand, there are swamps that are reported to be non-malarious, such as the Dismal Swamp, on the frontier of Virginia and North Carolina, the innocuousness of which has been ascribed to the peaty nature of the soil. The water with which this swamp is saturated, rather than covered, is of a brown colour, probably derived from the peaty bottom of the swamp. The marshes at Lake Winnebago in Wisconsin, in lat. 44° N., and on the Sault St. Marie, in lat. 46° 39′, probably owe their innocuousness to the low temperature of these places. This will appear all the more probable if we remember that the marshy shores of the southern extremity of Lake Michigan and those of Lake Erie by no means enjoy the same immunity. The influence of humidity of the soil on the etiology of malarial fevers will become still more evident by adducing individual instances, rather than from general statements of observation unsupported by precise statistical details. I shall quote only a few recent instances in which outbreaks of fever have been connected with marshy conditions of the soil, induced artificially, which I have met with in perusing the reports of the States' Boards of Health.

(*e*) An interesting account is given in the *New Jersey Report of* 1881 of an outbreak of malarial fever which was very evidently referable to the formation of an artificial marsh, and which disappeared when the natural drainage of the affected district was restored. The stream of Bound Brook, in New Jersey, empties itself into the Raritan River, just east of the town of Bound Brook. Obstruction of this stream resulted from the road-beds of two railways being carried across it, where a dam had previously been formed. The channel left did not suffice to carry off the heavy rains. The ultimate result of this obstruction, and of other agencies, was that the water backed over an area of some 60 to 75 acres, with accumulation of vegetable *débris.* The water was then drawn off during the day to supply motor-power to some machinery, and this artificially-formed *morass,* as it is termed, of vegetable matter and stinking mud was exposed to the sun. A disagreeable odour was perceived all over the neighbouring country, including the town of Bound Brook. The inhabitants of Bound Brook, numbering from 1000 to 1300, who had previously enjoyed good health, became affected with intermittent and remittent fevers, and with fearful neuralgias of different regions of the body; and this continued until, it is said, only one person in the whole community escaped the epidemy. This was in 1880. The dam was removed, a free course given to the stream, the marshy land converted into meadow, and the fever disappeared.

We read the following account of a somewhat similar occurrence in Connecticut, in the Report of 1882: "It will be remembered that in 1876, from the 28th of June to the 26th of July was a remarkably hot period, when the highest average daily temperature for twenty-eight days was over 90°. Ten days after the commencement of this temperature, there were six cases of chills and fever in the vicinity of Cook's Pond. In twenty days there were fifty new cases in a population of eighty-four. Some 30 acres of swamp-land had been overflowed the previous winter by raising the mill-dam. In May the pond had been so drawn as to expose all this land, some of which was muck. During last summer (1881) the land was protected by vegetation, mostly by fine water grass. There were no cases of chills or fever during the year."

Here is another example of the same kind: "The borough of Haddonville occupies a table-land; its drainage is entirely natural, and quite perfect. During the past year (1881) there has been more malarial disease than ever before, and this increase is marked at the north-east end of the town, which is surrounded, or rather bounded, by a chain of ponds. One pond (Evans') has filled at its head very rapidly within three years, and during the prolonged droughts this summer presented a seething, broiling mass to the rays of the sun. I cannot find evidence that the dry weather affected the purity of the drinking water to any great extent" (*New Jersey Health Report*, 1881).

Summing up the results of these observations on the geographical distribution of malaria in the United States, it may be said: 1st. That, other things being equal, malaria prevails more in the south than in the north. 2nd. That it diminishes and becomes less intense as higher altitudes are reached. 3rd. That it follows the clearing of forest land and the disturbance of the soil in malarious regions, gradually diminishing again as cultivation and drainage progress. 4th. That moisture, and especially stagnant moisture, in the soil favours its prevalence.

As regards the seasonal distribution of the disease, it appears—1st. That malarious fevers are most prevalent in autumn, although they manifest a tendency to a secondary spring rise, which in New England, and at some localities situated at high altitudes, is the principal one. 2nd. The autumn maximum follows, at the interval of about a month, the maximum of summer heat. 3rd. That the higher the summer heat in a given district, other things being equal, the more prevalent and intense will be the malaria.

Coming to the forms of fever met with in the United States, we find that they belong to two categories—the paroxysmal and the continued or sub-continued. The paroxysmal fevers are of the intermittent or remittent type, and may either be simple or complicated. The continued fevers include the simple continued, and the typho-malarial, typhoid, and mountain fever,—terms which are applied to some cases of true malarial fever, but which, as we shall see, are mostly typhoid in their nature.

The intermittent form of fever is that most generally met with throughout the Union. As a rule, the tertian is the most frequent type in the north, and is everywhere so in the colder months. The quotidian is the most frequent in some of the Southern States, such as Florida and New Mexico.

The complications of paroxysmal fevers are bilious, hæmorrhagic, melanuric, and congestive. The term *congestive* answers generally to that of "pernicious" as used in Europe, including the algid, choleraic, syncopal, apoplectic, and other forms of seizure supervening during the progress of an intermittent or remittent attack.

Of the simple fevers, the remittent is everywhere the most fatal; but the complicated forms are more dangerous than the simple.

During the years 1877–81 the deaths from the different forms of malarious fever in New Orleans were returned as follows:—

Intermittent, ...	125
Remittent, ...	331
Congestive, ...	903
Typho-malarial, ...	169
Unclassified, ...	599

I find nothing to show in what proportion of cases the congestive symptoms supervened upon the intermittent and remittent types respectively.

Congestive Fever is eminently a disease of the Southern States, and is most common from July to October, although sporadic cases occur throughout the year. Surgeon Lawson of the United States army says that congestive fever is an insidious malady, attacking most commonly the weak and enfeebled, and those labouring under mental depression. It must not be supposed, however, that the robust are exempt from the disease.

Wood states that he seldom saw the congestive fever in Philadelphia, except among sailors or medical students from the south or south-west. The synonym of "cold plague," used for congestive fever, indicates the greater frequency of the algid forms of pernicious attack.

Another form of cold plague is described as having attacked the soldiers at Baton Rouge on the Lower Mississippi, in the years 1821–23. It prevailed in May and part of June of each of these years. The symptoms were similar to those of cholera; the disease was ascribed to exposure while at work on the barracks which were then building, and to labouring in a cypress swamp for the purpose of obtaining timber. There can be no doubt that this cold plague was the choleraic form of pernicious fever.

The greater frequency of the hæmorrhagic form of malarial fever during the past quarter of a century, is a noticeable feature in the pathology of the Southern States. The hæmorrhage may take place from the nose, lungs, stomach, bowels, or kidneys, or may appear as petechiæ, or as ecchymoses of the skin or mucous membrane, or as effusion into the substance of different organs. Many cases, described as hæmaturic, are really hæmaglobinuric fever; but in certain instances blood corpuscles have been found in the urine, so that we are compelled to admit the occurrence of a distinct hæmaturic form. In most cases of blood-like vomit occurring in the course of malarial fever, the vomited matter is not blood,—not even disintegrated blood (as is the case in yellow fever),—but consists simply of altered biliary matters. Numerous cases, however, do occur of true hæmatemesis, the blood so discharged being sometimes copious and clotted. When black vomiting is associated with jaundice, the risk of confounding this disease with yellow fever is obvious; and it is impossible, in reading many of the older narratives, to say whether certain descriptions apply to the one disease or the other. As we have already remarked, the hæmorrhagic form is chiefly met with in the hot humid districts subject to inundations, or devoted to rice culture—particularly in Louisiana, Mississippi, Alabama, Texas, Georgia, and the Carolinas. If we define a pernicious fever as one in which the sudden supervention of a symptom, or train of symptoms, not being an exaggeration of the phenomena proper to the fever itself, puts life in jeopardy, then hæmorrhagic fever may justly be regarded as pernicious.

Remittent Fever in the States is frequently accompanied by jaundice, bilious vomiting, and pain or tenderness in the epigastrium, and hypochondria. This modification of the remittent type may assume after a few days a continued or sub-continued form, and often lasts from one to three weeks. In the Southern States this form not infrequently becomes complicated with pernicious symptoms. The localities in which the bilious remittent occurs may be inferred from the different names by which it is known. Thus it is called lake fever, river fever, marsh fever, and country fever. It is endemic near lakes, rivers, and marshes; and, except in an epidemic form, it is rare in hilly, dry, sandy localities, and in large well-paved cities.

The *Malarial Cachexia* in an extreme degree is to be met with in some of the worst fever localities. A description of this condition, given by a writer in the *United States Army Reports*, if not exaggerated, shows the disastrous influence of chronic malarial poisoning in the system. "Along the coasts of Florida," he says, "as in our Southern States generally, may be seen deplorable examples of physical, and perhaps moral, abjection, induced by marsh miasmata. In earliest infancy, the complexion becomes sallow, and the eye assumes a bilious tint. Advancing towards the years of maturity, the growth is arrested, the limbs become attenuated, and the viscera engorged. Boys of fifteen years may be seen bowed down with premature old age—a mere vegetating being, with an obstructed, bloated, dropsical system subject to periodic fevers, passive hæmorrhages, and other forms of disease which follow in the train of malaria."[1] It would be an error, however, to suppose that such cases are common in Florida.

Of the continued fevers, the ubiquitous form, called *Common Continued Fever*, judging from the army returns, is less frequent in the States than in many other countries. Nor is it more general in the south than in the north. It appears to be most frequent in the north interior region, between the great lakes and the Atlantic, and least frequent in the middle interior region, between the Atlantic slope and the Mississippi, and the corresponding slope from the Rocky Mountains to that river. The interior and Gulf coast of Florida, although in parts highly malarious, returns a slightly smaller proportion of cases of continued fever than the North Atlantic region. It is not so distinctly a seasonal disease as malarial fever, and frequently attains its maximum in the second quarter. I am unable to throw any light upon its character and causation.

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[1] *United States Army Reports*, 1856–59.

Typho-malarial Fever first attracted attention, and received this distinctive name, in the United States, where it was very common among the troops encamped in the valley of the Mississippi and near the Potomac, the Ohio, and the Chickahominy rivers. Its diffusion differs widely in different States, and it is difficult to say with any certainty whether it is met with more commonly in malarious or in non-malarious localities.

The population of the city of New Orleans, in 1887, was 242,750. The number of deaths ascribed to typho-malarial fever in that year was 41, or 0·17 per 1000 living. In the State of Alabama, for the same year, the deaths were 103 in a population of 734,579, or 0·14 per 1000. The population of Connecticut in 1880 was 622,700, and the deaths ascribed to typho-malaria were 135, which gives a ratio of 0·24 per 1000.

These data are too limited to justify any statement as to its distribution, but they warrant us in concluding that typho-malarial fever may be more prevalent in the north than in the south, and that it is not necessarily most prevalent in the most malarious localities.

Apart from the ordinary typhoid, traceable to specific typhoid infection, there occur in the United States, as in many other countries, numerous cases of fever in which the lesions of enteric fever are met with, but which differ from what we may call typical typhoid in the following particulars:—1st. They are often sporadic, and cannot be traced to infection from water or air, polluted with anything derived from a previous case. 2nd. The rose spots are generally absent. 3rd. Constipation is quite as common as diarrhœa. 4th. These cases seldom present the normal thermal curve, but often begin as a remittent or intermittent.[1]

These are the cases generally denominated typho-malarial. Webb insists that sporadic cases of this nature occur "with none other than the ordinary miasmatic influences to account for their origin, and all absence of evidence of an infectious character." He is inclined to regard these cases as malarious; but it does not follow that they are malarious because they are miasmatic.

We have already observed in numerous regions the existence of a fever of miasmatic origin, which it is impossible to trace to an infection caused by the dejecta derived from a previous case of enteric fever. We have seen that the symptoms are everywhere the same as those just enumerated, and that the lesions discovered in the bodies of those who die of the disease are entirely similar to those which are met with in the miasmatic-contagious form of the disease. The confusion as to the etiology of this disease arises from the non-recognition of a miasmatic form of typhoid, and the widespread belief that every case of typhoid fever must have its origin in a germ or virus derived immediately from a previous case. Typho-malarial fever is a term which includes both true typhoid and also malarial fever with typhoid symptoms,—a disease which is by no means rare in malarious localities, but which never presents the lesions characteristic of true typhoid, whether miasmatic or miasmatic-contagious. We need not suppose that there is any essential difference between the two forms of typhoid to which we have referred. The typhoid germ is probably a facultative parasite,—one that can multiply and maintain its life indefinitely outside the human body; but it is, at least, conceivable that the symptoms of typhoid in its miasmatic form differ somewhat from those which are caused by the germ that has been cultivated, so to speak, within the human body, and these differences manifest themselves in those minor peculiarities that are described as characteristic of typho-malarial fever with enteric lesions.

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[1] Webb, *American Journal of the Medical Sciences*, April 1883.

Mountain Fever.—Another form of fever, which differs in no respect from that which we have been considering, is the disease known as "mountain fever." This disease has been met with at Fort Bridger, in Wyoming, at an altitude of 7000 feet; at Camp Floyd, in Utah, at 4725 feet; and in the elevated districts of California and Colorado. At Fort Bridger it was observed to occur in the months of May, June, and July; and at Fort Fetterman, in Wyoming, it is stated to be a disease of late summer or early autumn. Dr. Brewer says that the epidemy of this fever, seen by him at Camp Floyd, began in July and lasted up to October. At Fort Bridger it was regarded as malarious. It was ascribed to the water supply, which was derived from the melting of snow on the hills, and which was found to contain much organic matter. The theory was that the malarial germ, suspended in the moist air of the malarious valleys during the autumn season, was wafted up to the cold summits of the Rocky Mountains, and there precipitated along with the snow. When the snow melted, the germ was then suspended in the water which formed the supply of the fort. The theory is ingenious. No objection need be taken to it on the ground of the distance between the malarious plains and the snowy peaks of the Rocky Mountains. Fischer, a surgeon in the German Navy, found that land-grown germs can be transported out to sea for a distance of from 70 to 120 miles; and Dr. Bujwid[1] has lately found micro-organisms in hail. The soil of Fort Bridger was supposed to be non-malarious, for it is stated that cases of intermittent fever taken there recovered rapidly; but this is open to doubt.[2] Malarial fever probably, and typhoid fever certainly, occurs there, the latter in a modified form.

Brewer's observations at Camp Floyd do not, however, support the view that the disease is owing to snow-water. The snow there disappears from the mountains in July and August, and begins to fall again in September. The disease, as we have seen, begins in July, when the snow has begun to disappear, and continues during the months when no snow is visible. It also occurs at places where little or no snow-water is received, and does not occur in localities where such water is abundant. In some of the localities where it has been observed, the existence of malarious influences cannot be excluded. Camp Floyd itself is situated on the banks of a stream which is to some extent marshy, and numerous excavations filled with stagnant water exist in the neighbourhood. The conditions favouring marsh miasm thus exist near the Camp. The average mean daily temperature and rainfall at this station from July to November are as follows:—

	July.	Aug.	Sept.	Oct.	Nov.
Average Mean Temperature, .	76·47	72·14	58·59	50·06	36·27
Rainfall, ...	2·67	0·18	1·72	0·00	3·31 (rain and snow)

The disease is ushered in by chilliness, lasting from ten minutes to an hour or more, and followed by fever, headache, pain in back and limbs, and occasionally by delirium. These paroxysms of chills and fever appear at all hours of the day—the remissions occurring indifferently in the morning and at night. During the first few days, almost perfect intermissions occur. As the disease progresses, the fever assumes a more distinctly remittent type, and later on the remission becomes less and less marked. In the early period of the disease, copious and exhausting perspirations are the rule. After the disease has assumed the remittent or pseudo-continued type, the skin becomes dry; the tongue, which at first is smooth, flabby, and moist, becomes brown, fissured, and bleeding. The fever seldom reaches a high grade. The pulse, at first fast and compressible, is afterwards small and feeble. No enlargement of the liver or spleen could be detected. The duration of the disease is stated to have been from three to thirty days. Quinine appears to have been of slight service, and only during the period of intermission or remission. Bartholow notices severe aching of the limbs, and the slowness of the convalescence, which is often announced by violent pains in the soles of the feet, increased at night.

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[1] "Bactéries de la Grêle," *Rev. d'Hygiène*, June 1888.

[2] See Bartholow's description of the topography of the fort, *Stat. Rep. U.S. Army*, 1855–60, Washington, p. 306.

Kober, speaking of the disease in California, says that it is ushered in by chills, repeated during one or two days. There is often slight pharyngeal and nasal catarrh; the temperature reaches 101°–104° F., and in the first stage exhibits marked exacerbations and remissions, suggestive of quotidian and remittent fevers. Epistaxis and abdominal symptoms are rare. There is no eruption; sweating is more common than in typhoid. The fever continues for four or five weeks, and in the graver forms abdominal and adynamic symptoms develop. Early treatment usually cuts the disease short; but, if neglected, it runs into the typhoid stage, and quinine has then no curative influence. He believes that this fever is due to an union of the typhoid and malarial poisons. This view, however, is scarcely consistent with his own statement, that he has often seen the disease attack men who lived in places where it seems impossible that the typhoid germ could have existed.

Hoff, who observed the disease at Fort Fetterman, in Wyoming,[1] also identifies it with typho-malarial fever. The only case which proved fatal presented undoubted lesions of typhoid fever. He, too, looks upon it as a hybrid disease, the prominent features of which are typhoid, the modifying element being intermittent fever. He apparently hesitates to call it typhoid fever pure and simple, because it appeared in a region "hitherto almost undefiled by human foot, leaving out of consideration human settlement." This is precisely what we have seen occurred in Afghanistan. Typhoid fever has there broken out in camps situated in districts where no human being had ever probably lived before. "It seems," Hoff says, "to have no relation to typhoid infection as is now usually accepted by the profession." No doubt this is true; but here, again, the source of error lies in the supposed necessity for every case of typhoid being traceable to an infection from a previous case. How, may we ask, is the disease supposed to be a *hybrid?* For the production of the hybrid two elements are required—the malarial and the typhoid. Whence, then, the typhoid element, which he regarded as the dominating one, in the region and under the conditions which he describes?

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[1] *American Journal of the Medical Sciences*, Jan. 1880.

His argument, that because the germ of simple typhoid could not be supposed to exist in the locality, that therefore we must assume both the typhoid and malarial germs to exist, is illogical in the last degree. There cannot be the slightest doubt that typhoid fever often occurs in persons who are under the malarious influence, and that the disease is thus modified, just as pneumonia is often modified when it occurs in a person suffering from the malarial infection. But we are not compelled to assume that in such cases we have to do with a hybrid disease. Many cases of so-called mountain fever are probably malarious. The typhoid cases may be justly regarded as instances of miasmatic enteric fever. It will be noticed that in almost all, if not in all, the fatal cases of mountain fever, the lesions are those of typhoid fever.

The epidemic recurrence of malarial fever in certain States, and the periodic variations of type which is often observed within a given region, deserve special attention. It has been observed that certain regions, which have been healthy for one or two generations, have again become malarious, and that, in malarious districts, certain series of years have been noted as specially unhealthy, and, again, that certain special forms or types of the disease succeed each other at intervals, and perhaps in cycles; and all this without any assignable cause for these changes. Such recrudescences, extensions, intensifications, and variations in type of malarious fevers have been noticed in different parts of the Union. Dr. Adams informs us that from 1800 to 1850 ague was almost unknown as an endemic disease in New England. In the latter year it appeared on the shores of Long Island Sound, in Connecticut, and about 1864 it began its epidemic march northwards, across the western half of the State, and in 1875 reached the northern boundary, and invaded Massachusetts in 1877, advancing rapidly in the three following years, and invading a considerable number of towns in the latter State.[1] We learn from Wilson[2] that, later on, in its northward march, it invaded Vermont, New Hampshire, and also extended to Rhode Island. As regards its causation, this writer makes the following observations:—

"In this epidemic we may be sure that ague is not produced by 'heat, moisture, and decay,' arising from ponds, reservoirs, swamps, or low grounds, overflowed by freshets, or exposed by evaporation; for new cases arise at any and all seasons of the year, and upon the highest land, as it has done in one-third of the towns in the State; nor by uncovering lately submerged lands, for in most towns no such lands exist. Not only does the disease not appear under the conditions appropriate to the paludal theory, but it does not confine itself to, or remain in, the alluvial tracts, even when established upon them.

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[1] *Massachusetts Health Report*, 1880.

[2] *Report, State Board of Health of Connecticut*, 1882.

"Not from 'disturbance of earth,' by grading, ditching, or railroad building in the country, or by laying down sewers, or gas, or water pipes in towns; for these operations have been going on for ages, while no ague came because of them, and it did appear at the same relative time in territory whose surface had or had not been disturbed.

"Not from the 'transportation of clay, manures, or other decaying and fermenting substances, from New Jersey and New York,' or of sawdust in the river beds, floated down from the mills of the north; for in several towns so affected none of these things have been introduced to this day, and in others, the disease failed to appear at the time called for by the theory.

"Not from 'stagnant, or even foul water,' no matter how offensive to smell or taste; for water with these qualities has always existed in many towns free from ague, and, on the other hand, many tracts of dry and sandy soil have been its favourite haunts.

"Not from *bacillus malariæ* in the water, which would be carried *with* the current; while ague moves up stream, and *against* the current of every principal river in Connecticut.

"It cannot be from germs carried by winds; for the direction for the year, in the State, and in New England generally, is north of west, and is very rarely, and for a short time only, in the direction of the ague movement."

But all this is just what is usually observed in true epidemies of malaria. We have already noticed elsewhere that epidemic malarial fever does not confine itself to such localities as are the favourite seats of the endemic disease, and that its spread is not materially influenced by meteorological conditions.

One of the most interesting points in connection with this epidemy was its influence on the prevalence of enteric fever. In Connecticut, "from causing four or five hundred deaths in a year, typhoid fever has so decreased in importance that three years ago (1879) it was credited with only one hundred and fifty-nine deaths." This decrease in the prevalence of typhoid fever only lasted during the period when malaria was epidemic. We find it stated in 1884, that "malarial diseases have decreased, and typhoid fever increased proportionally in many towns." Even as early as 1882, it was noticed "that in regions where malarial fever had been longest prevalent, cases of acute intermittent had become exceptional, while the obscure forms, and those more like the type of continued fever, and typho-malarial fever, have been common." The acute cases of intermittent abounded as the malarial wave advanced, and became less frequent as it receded. Dr. Chamberlain noticed that in this epidemy, after malaria had existed for some time in a district, comparatively few cases of acute intermittent occurred, but congestive chills, usually fatal, were oftener reported (*Connecticut Board of Health Report*, 1882, p. 15). But although it is certain that typhoid fever, as a rule, diminished while the epidemy raged, there were so many exceptions to the rule as to show that there was no necessary antagonism between the two. Another fact of importance, bearing upon the supposed antagonism of these two fevers, is that the decrease in typhoid fever was not limited to the regions where malaria was then actually reigning, but extended to those counties not yet reached by the advancing malarial epidemy. Whatever may be the explanation of these facts, it is remarkable that, in proportion as the malarial epidemy subsided, typhoid fever resumed its old sway.

The same inverse relation between the prevalence of malaria and typhoid fevers has been observed in other States of the Union, where no epidemy has been raging. Thus, Johnson says of Washington, "as malarial diseases are lessening, typhoid fever is increasing."[1] The diminution in the frequency of typhoid fever for a series of years, whether this was dependent upon the spread of the malarious miasm or not, is a fact of great importance in relation to the etiology of typhoid fever, and is certainly suggestive of the view that it is to a considerable extent, even in temperate regions, a miasmatic disease. If the disease were entirely caused by accidental pollutions of a specific nature, this cyclical character would be altogether inexplicable.

The changes in type which fever in a given locality may undergo, during certain cycles, is no less deserving of notice. Webb says that soon after the settlement of Sumter County, Alabama, in 1832–33, intermittent and remittent fevers made their appearance, and from 1835 to 1842 the country was noted for the variety and severity of its malarial fevers. The cold stage was then the prominent feature of the disease. The chill was followed by a fever of short duration and high grade, and went off with profuse perspiration. In six to eight hours the patient was up and following his usual avocations. In the autumn of 1835, these intermittents were accompanied by occasional remittents, but it was not until the summer and fall of 1836 that the remittents had become the prominent variety. The cold stage was distinct, the fever high, and gastric and hepatic symptoms prominent. After eighteen or twenty hours, a moderate perspiration would ensue, with a remission of the symptoms; this remission was soon followed by an exacerbation, and, unless promptly relieved by treatment, the patient passed into a state of delirium and fatal collapse. Along with these cases there were mingled the algid variety of congestive fever. These were the typical malarial fevers from 1836 to 1842.

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[1] *American Journal of the Med. Sciences*, Oct. 1882.

From that time the fever began to be less frank, and by 1845 it had gradually assumed a typhoid form. The cold stage was less marked, the fever less intense, the remission less distinct, and of shorter duration.

In 1845, typhoid fever was imported from Virginia by a company of negroes, and prevailed until 1855. This was an epidemic of true typhoid, as was indicated both by its symptoms and lesions. This epidemy began to disappear in 1855–56. From 1860 to 1866 there were only mild intermittents and remittents. For the ten years 1856 to 1866, Webb says he does not remember to have seen a case of typhoid. In 1866 another wave of malarial fever set in, and in 1867 the fearful variety, known as the hæmorrhagic malarial fever, made its appearance, and prevailed until 1872. Since then it has been rare, only an occasional case being seen. On the decline of this variety, malarial fevers assumed a remittent type, with low grade of fever and very slight remissions, until they gradually attained the characteristics of what are now known as typho-malarial or continued malarial fevers, and, according to some, as typhoid fever.[1]

Yellow Fever, which seems to have been unknown in New Orleans before 1791, has found, during this century, one of its chief areas of diffusion in the Southern States of the Union—the region of its greatest prevalence corresponding with Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina. Although this region has been that where the disease has most frequently manifested itself, and within which it has proved most severe, it has often appeared at points farther to the north, such as Baltimore, Philadelphia, and New York, and more rarely at some of the coast towns of New England. Following the Mississippi, it has penetrated the central valley as far as Memphis. Yellow fever has only on rare occasions appeared in inland localities at a distance from the sea, or from the banks of rivers.

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[1] Webb, "Typho-malarial or Continued Malarial Fevers," *American Journal of the Medical Sciences*, April 1883.

Some of the epidemic outbreaks in the south have proved very destructive. At New Orleans, for example, yellow fever caused 4845 deaths in the year 1858, and 4046 in 1872. During the nine years 1879–87, the average number of deaths had fallen to 3·11 per annum, and in 1886 and 1887 no death was recorded from this disease. An almost complete extinction of yellow fever has been witnessed during late years all along the South Atlantic and Gulf coasts, and this is ascribed to the more strict enforcement of quarantine, and the thorough carrying out of disinfection. The immunity thus gained seems to show that yellow fever is not endemic in the Southern States, as was formerly supposed to be the case, but that it is always introduced from without.

The monthly distribution of 31,305 deaths from yellow fever, occurring in New Orleans, during a period of thirty-two years, has been as follows:—

January, . .	6	April, . . .	0	July, . .	2,248	October, .	5,714
February, . .	0	May, . . .	5	August,	10,639	November,.	1,177
March, . . .	2	June, . . .	49	September,	11,346	December, .	119

It will be seen that yellow fever is chiefly confined to the warmest season of the year, attaining its maximum in the months of August and September, and dying out during the first five months of the year. In the Northern States it has seldom occurred, excepting in the warmest months, when the temperature has been over 68° F.

Enteric Fever is given as the cause of 30·19 per 1000 of the total deaths during the census year 1880, as compared with the English average (1870–79) of 15·69. The death-rate per 100,000 living was 34·6 for the cities and 47·5 for the rural districts, which, it must be remembered, includes villages and small towns. The white population suffers somewhat more than the coloured from typhoid—the proportion of enteric deaths to 1000 deaths from all causes in the former being 33·9, in the latter 31·7. The age periods most liable to typhoid extend from 15–25.

The table opposite gives the distribution of typhoid fever in the individual regions which we have already defined.

I am unable to explain the distribution of enteric fever as shown in this table by any general law. Geographical position, physical configuration, altitude, and climatology, fail to furnish us with a satisfactory explanation of the distribution of the disease. The areas of its prevalence appear in patches scattered irregularly all over the map of the States.

Typhoid prevalence is clearly not determined solely or chiefly by latitude, for areas of maximum and of minimum enteric intensity

Table showing for Rural Districts and Cities, with Distinction of Sex, and for White and Coloured, Irish and German Parentage, the Proportion of Deaths from Enteric Fever in 1000 Deaths from known causes.

Grand Groups.	Rural.		Cities.		White.	Coloured.	Irish Parentage.	German Parentage.
	Male.	Female.	Male.	Female.				
1. North Atlantic Coast Region,	21·3	18·5	17·3	15·2	...	...	15·7	16·9
2. Middle Atlantic Coast Region,	27·0	22·1	9·3	10·9	13·4	22·4	6·6	13·5
3. South Atlantic Coast Region,	34·1	31·9	34·5	20·1	43·3	25·4	...	...
4. Gulf Coast Region,	30·1	31·2	7·4	8·0	21·8	23·0	...	...
5. North-Eastern Hills and Plateaus,	25·5	20·3	22·3	15·8	...	...	19·9	30·9
6. Central Appalachian Region,	21·7	21·1	12·3	18·8	...	...	12·5	23·0
7. Region of the Great Northern Lakes,	28·6	26·8	14·9	19·6	...	...	23·1	26·7
8. The Interior Plateau,	32·6	34·4	26·1	25·1	31·1	31·1	32·3	40·8
9. Southern Central Appalachian Region,	47·1	46·4	...	...	47·6	44·3	...	...
10. The Ohio River Belt,	44·3	40·8	26·5	19·4	39·0	24·2	23·8	36·5
11. Southern Interior Plateau,	40·0	43·9	...	...	46·9	38·4	...	...
12. South Mississippi River Belt,	18·4	21·8	...	...	24·4	16·6	...	...
13. North Mississippi River Belt,	38·8	41·7	20·6	17·9	...	...	34·9	51·8
14. South-West Central Region,	46·9	49·1	...	...	51·3	34·6	...	...
15. Central Region Plains and Prairies,	44·2	40·2	52·1	44·9	43·5	36·4	...	...
16. The Prairie Regions,	43·9	41·9	...	...	...	...	34·2	37·4
17. Missouri River Belt,	39·4	42·1	25·4	11·0	...	...	23·0	56·3
18. Region of the Western Plains,	41·1	40·5	...	...	...	...	26·0	84·5
19. Heavily-timbered Region of the North-West,	30·2	26·1	...	...	...	...	24·8	26·4
20. Cordilleran Region,	33·3	27·4	...	...	...	...	23·8	21·2
21. Pacific Coast Region,	28·2	43·2	21·8	25·1	...	...	23·9	29·6
Total,	36·1	35·9	16·7	16·7	33·9	31·7	17·4	29·6

are found alike in the north and south. Yet while this is the case, it must be noted that the chief areas of typhoid prevalence are to be found south of latitude 41°, from which it may be inferred that a high temperature, although not necessary, is favourable to its spread.

Altitude, by itself, has little influence on the prevalence of enteric fever. The Atlantic and Pacific Coast Regions are comparatively slightly affected, but so also are the elevated plains of the Cordilleran Region; and, both along the coasts and on the Cordilleran table-lands, we meet with localities that form exceptions to the rule. Thus we find North Carolina and Oregon standing out in marked contrast to other parts of their respective coasts, while, in the Cordillera Region, Arizona, the western part of Colorado, Idaho, and Oregon, appear as typhoid islands or promontories in the midst of a vast region in which the disease is at its minimum; and this without our being able to point out any peculiarities in the configuration of the country, in the character of the soil or climate, or in the social condition of the inhabitants of the affected districts, which account for the exceptional prevalence of the disease in these districts.

The Mississippi Belt, which is notably malarious, enjoys a remarkable immunity from typhoid fever, but close at hand we have the Ohio River Belt, also decidedly malarious, where typhoid fever is in some parts endemic. The northern portion of the Appalachian Region, corresponding to West Virginia, is slightly affected, but the southern portion, corresponding to Alabama, suffers to a great extent, while both are comparatively free from malarious influences. We have probably to look for an explanation of these apparent anomalies in the distribution of enteric fever in local or topographical conditions, rather than in the more general geographical features of the country. We have already attempted to show that much of what is spoken of as "typho-malarial" and "mountain fever" is really miasmatic typhoid.

The monthly distribution of 100 typhoid deaths in thirty-one registration cities, in 1879–80, was as follows:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8·2	7·5	7·7	9·2	6·8	4·7	5·6	10·0	10·9	10·8	8·6	9·0

Typhus Fever has only shown itself in America in connection with immigrants from Ireland, and has been limited to a few seaports in the Eastern States. In most instances it has remained limited to the immigrants themselves, or to those brought more intimately into contact with them; but it has occasionally spread, to a limited extent, in the more crowded districts of Boston, Philadelphia, and New York.

Relapsing Fever, like typhus, has only been observed at some places in the Eastern States into which it had been introduced by immigrants from Ireland. It has never spread to any great extent among the population of the towns in which it has appeared.

Cerebro-Spinal Meningitis prevailed in an epidemic form in Virginia, Kentucky, Ohio, New York, and Pennsylvania in 1808–9, and in various parts of New England from 1814 to 1816. It was again observed in Middletown, Connecticut, in 1823, and at Trumbule, Ohio, in 1828. From 1842 to 1850 it appeared in isolated epidemic outbreaks, at many points on the eastern and central States, north and south, and in still wider diffusion during the period 1857–73, but sparing, so far as I can learn, the Cordilleran and Pacific Regions. The disease prevailed to a large extent among the troops of both armies during the War of Secession, 1861–63. The negro troops also suffered from the disease.[1]

Erysipelas.—Hirsch has given a chronological table of some sixty-four more or less localised epidemics of malignant or typhoid erysipelas, in the United States, from 1826 to 1880, which shows that this disease is to be looked upon as specially prevalent in this country. No part of the Union has escaped these visitations, but they have been most numerous in the Western States — Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, and Minnesota, and in the East-Central States—New York, New Jersey, and Pennsylvania. This is probably a distinct affection from ordinary erysipelas.

In the census year 1880, the deaths from erysipelas were in the proportion of 565 to every 100,000 deaths from all causes; the ratio in England being about 404. The disease is more fatal to males than females, in the proportion of 6·07 to 5·80. The greatest proportion of deaths occur under two years of age; the frequency of death from the disease then diminishes to the age of five, after which it again increases until seventy. Erysipelas is most prevalent on the prairies and south-west central plains; it is also of frequent occurrence in the Cordilleran Region. The disease is less common along the Atlantic and Pacific coasts, and generally in the country east of the Mississippi.

Influenza has been as frequently epidemic in the United States as in Europe, and has invaded the most remote and sparsely-peopled districts of the west and south, as well as the more densely peopled regions of the north and east. The first epidemy of influenza that is known to have occurred in the Western hemisphere was that of

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[1] For a list of these outbreaks, see Hirsch.

1627. The principal outbreaks in the United States since that date have been in 1732–33, 1737–38, 1757–58, 1789–90, 1807, 1815–16, 1824–25, 1831–32, 1843, 1850–51, 1874–75, 1889–91.

Diphtheria was either unknown in America before the year 1856, or it was not distinguished from croup, which is probably indigenous to North America. Both diseases are, at the present time, extremely prevalent in the United States; the mortality from diphtheria being 75·3 per 100,000 living in the rural districts, and 80·0 for the cities; while that from croup reaches 35·1 in the country, and 40·8 in the towns.

As in Europe, so in America, many physicians look upon croup and diphtheria as synonymous terms; others regard croup and diphtheria as distinct diseases. As a result of this diversity of opinion, little reliance can be placed on the returns as a source of information respecting either disease separately. Taking the returns, however, as they stand, we find that diphtheria caused 5039 out of 100,000 deaths from all causes, and croup 2374 per 100,000. In England, during the year 1880, the deaths from diphtheria were in the ratio of 532, and in 1884 of 945 per 100,000 deaths from all causes. The proportion of deaths from diphtheria is greater in females than in males, while the reverse is the case in croup. Another point of difference comes out in the returns. Croup is more distinctly a disease of infancy than diphtheria; the mean age of death from the former, during the census year, was two, and from the latter six years. The white are more liable to both diseases than the coloured population; and this difference is more accentuated in the case of diphtheria, in which the mortality of the whites is double that of the blacks. Children of German parentage appear to be specially subject to diphtheria.

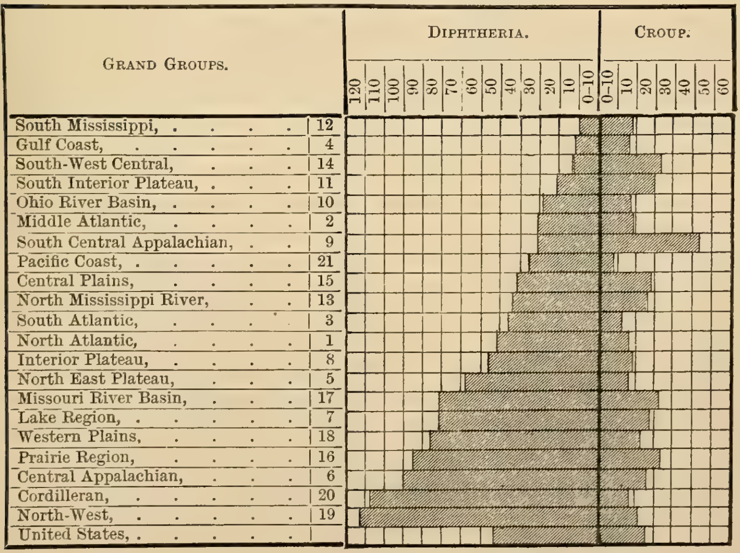
Diphtheria was most prevalent in 1879–80 in the region situated to the north of the 37th parallel; to the south of this line it was of rare occurrence. This relation, indeed, is so marked, that we must assume that a warm climate is unfavourable to its spread. To the north of the 37th parallel, the localities most severely affected are Maine; the central portion of Pennsylvania; the north-east corner of the State of New York, from the St. Lawrence River east to Vermont; the Heavily-timbered Region of the North-West, in the vicinity of the great lakes; and, to a lesser but still marked degree, Iowa and the North-Western States and Territories to the Pacific, excluding Nevada and California, especially the sea-coast of the latter State, which is almost exempt from the disease. It is thus found to prevail in the moist cold coast and lake districts of the north, and in the dry elevated regions of the west; but seems, upon the whole, to be most intense in the cold moist regions.

The regions that suffer least are Nevada and California, Arizona, New Mexico, and Texas. In the southern half of the Mississippi valley, especially the south Mississippi Belt, with its rich, damp soil and rank vegetation, and the Ohio River Belt, the disease is less frequent than in any part of the United States. The States of Mississippi, Alabama, Florida, Kentucky, and the east Atlantic coast from Connecticut southwards suffer only in a minor degree. When, however, we examine the distribution of the disease more in detail, we find that in the same region different localities are affected very unequally. It appears in circumscribed epidemies in the regions where it prevails, and is not uniformly diffused.

Croup finds its chief areas of prevalence in the eastern portions of Nebraska and Dakota, in Wyoming and Oregon, and in the mountain regions of Virginia, Kentucky, North Carolina, Tennessee, and Georgia. The regions in which croup is exceptionally rare are New England, the South Atlantic Coast, the Gulf Coast, the Cordilleran Region, with the exceptions already mentioned, and Texas. The Mississippi, Ohio, and Missouri River Belts are remarkably free from croup.

The following diagram, from the official census report, will illustrate the incidence of diphtheria and croup on the various Grand Groups into which the country is divided:—

DEATHS FROM DIPHTHERIA AND CROUP, IN TWENTY-ONE GRAND GROUPS, PER 1000 DEATHS FROM KNOWN CAUSES.



Taking the two diseases together, which we shall call croup-diphtheria, we find the disease, upon the whole, to be much more prevalent in the region north of the 37th parallel than to the south of that line. Those districts to the south of this line that furnish the largest number of cases are generally elevated and mountainous. The distribution of croup-diphtheria is thus very distinctly influenced by latitude, the colder regions of the north suffering most. The Southern States of California, Nevada, Arizona, New Mexico, Texas, Mississippi, the southern portion of Alabama, the whole of Florida, the Middle and South Atlantic Coasts, the Gulf Coast, and the Pacific coast south of latitude 42°, are notably free from the disease, as are also the marshy south Mississippi Belt and the Ohio River Belt. A warm climate, whether dry or moist, is inimical to its development. A cold climate, whether dry or damp, favours its spread. Croup and diphtheria are most fatal in the cold months, from October to January.

The fact that a given region where it prevails is very unequally affected, indicates that some other circumstance than climate comes into operation. It does not appear to be related, as Billings points out, to methods of filth disposal; for, if stored filth alone will cause diphtheria, it should prevail in nearly every county in the United States.

Asiatic Cholera first invaded the States in 1832, spreading during the three following years from coast to coast, committing great ravages, especially amongst the negro and Indian races. The second great visitation of the disease occurred in 1848–52, during which no part of the country escaped. For a third time the whole country was overrun by the disease in 1854. A fourth epidemy, which fell with special severity on the Mississippi valley, occurred in 1866–67. The fifth, and last, epidemy broke out in 1873, when the Mississippi valley was again the region in which it created the greatest ravages. Since that time the United States have had no recurrence of the pestilence. The appearance of cholera in the States has always been traced to importation from Europe.

Diarrhœal Diseases, which include all deaths reported as due to diarrhœa, dysentery, cholera, cholera infantum, and enteritis, gave rise in the census year to 8454 deaths out of 100,000 deaths reported. The proportion of deaths to the total mortality in England, in 1884, was 5737. It thus appears that this class of diseases is excessively fatal in the United States. The deaths per 1000 of all diseases for each member of the group is given as follows: dysentery, 18·65; diarrhœa, 15·03; enteritis, 17·56; cholera infantum, 34·71. It will be remarked that, whereas in

England, and in the greater part of Europe, diarrhœa is by far the most fatal of this class of maladies, here it occupies the third place in the order of fatality—dysentery and cholera infantum standing out as the most destructive of the intestinal diseases.

Diarrhœal affections cause a greater proportion of deaths in the large cities than in the rural districts, and among the white than among the coloured population; a vast proportion of the deaths occur under the age of three, and the mean age of those reported as having died of diarrhœal diseases in the census year was twelve years.

As this class is composed of diseases more or less distinct etiologically, it would be useless to enter into any detail as to its geographical distribution. Suffice it to say, that diarrhœa and cholera infantum are specially common in great cities; that their distribution is influenced, not so much by the mean annual temperature of a given locality, as by the height of the summer temperature—the highest mortality occurring in July and August. The excessive prevalence of cholera infantum is one of the most marked features in the pathology of the United States.

The special distribution of dysentery can only be traced from the incidence of the disease in the United States Army. The following table from Hirsch gives the admissions and deaths per 1000 during the period 1839–59:—

TABLE SHOWING THE ADMISSIONS AND DEATHS PER 1000 FROM DYSENTERY IN THE UNITED STATES.

Locality.	Period.	Admissions.	Deaths.
Around the Great Lakes,	1839–59	28	0·37
Eastward of the Lakes,	,,	33	...
Utah Territory,	1857–59	46	0·34
Newport Barracks, Ky.,	1847–59	53	2·02
California, Northern Division,	1849–59	56	2·60
,, Southern Division,	,,	58	2·33
Westward of the Lakes,	1839–59	62	0·94
New Mexico,	1849–59	65	1·71
Oregon and Washington Territories,	,,	73	0·78
New England, seaboard,	1839–59	78	0·22
New York Harbour,	,,	81	2·09
Interior, Central, and Western,	,,	86	1·14
Carlisle and Alleghany, Pa.,	,,	92	0·26
Atlantic, Central,	,,	99	0·95
,, Southern,	,,	109	0·88
Interior, Southern, and Eastern,	,,	125	3·01
Texas, Southern,	1849–59	146	3·83
,, Western,	,,	149	2·50
Interior, Southern, and Eastern,	,,	176	4·36
Florida, Atlantic side,	1839–59	187	3·27
,, Interior and Gulf Coast,	,,	213	4·32
Jefferson Barracks and St. Louis (mostly recruits),	,,	224	3·74

It will be observed that the admission and death rates do not always correspond. California, North and South, has a low admission-rate, but a somewhat high death-rate; the Central and Southern Atlantic Region, a rather high admission-rate and a low death-rate; but it is evident that, upon the whole, the admissions and deaths are more numerous in the south than in the north. Dysentery frequently assumes an epidemic form over larger or smaller areas of the States, and certain cycles of years in a given locality are marked by a high dysentery mortality.

In the northern and middle divisions, along the Atlantic coast of Florida, in West Texas, in North California, in Oregon, Washington, and Utah, dysentery is most prevalent in the third quarter; in the interior and Gulf coast of Florida, Georgia, Alabama, Mississippi, Louisiana, and the south-west interior, the greatest number of admissions occur in the second quarter; while in New Mexico and South Texas, the disease is most frequent in the fourth quarter. In the South Atlantic Region dysentery is equally prevalent in the second and third quarters.

Smallpox is by no means a fatal malady among the white and coloured population of the United States. We shall refer in the sequel to its prevalence among the Indians.

Scarlet Fever.—The number of deaths from scarlet fever in the census year 1880, per 100,000 deaths from all causes, was 2165, as compared with the English average for the ten years 1870–79 of 3674. But this is a disease that varies very much in frequency in different years; the proportion in the census year 1870 was nearly double that of 1880. It is more fatal in the cities than in the country in the ratio of 26·7 to 21·6. The proportion of deaths among the white population is nearly seven times as high as amongst the coloured. The disease is much more prevalent in the north than in the south. This is in keeping with the almost entire absence of the disease from tropical and sub-tropical countries. The greatest mortality from this disease occurs in the winter months—November, December, and January.

Measles.—The proportion of deaths from measles, in the census year 1880, per 100,000 deaths from all causes, was 1066, and in 1870 the ratio was 1876. In England and Wales the ratio for the ten years ending 1879 was 1700 per 100,000 deaths from all causes. We infer, therefore, that measles is about equally prevalent in the two countries. It presents two striking contrasts to scarlet fever—(1) the proportion of deaths from measles in the rural districts is considerably higher than that of the cities; (2) the coloured population is more liable to die of the disease than the white, in the proportion of 17·7 and 9·1 respectively. The disease, unlike scarlet fever, is not influenced by latitude. Warm regions suffer as much as the cold. In 1880, measles was most severe in the Missouri River valley and the regions of the western plains. In America it is notably a seasonal disease. More than half the total number of deaths occur in the three months, March, April, and May.

Phthisis is the most fatal of all diseases in the United States. In 1880 it caused 12,059 in every 100,000 deaths, as against the English average (1870–79) of 10,159. In the cities consumption is more fatal to females than to males in the proportion of 144·3 to 131·9; in the rural districts the proportion is 101·9 males to 146·6 females. It is slightly more fatal in the coloured than the white race, with the exception of those of Irish parentage, who are specially subject to phthisis. The towns generally suffer more than country districts in about the ratio of 100 to 89, but in some regions, such as the North Atlantic Coast, this relation does not obtain.

The table on the following page gives the distribution of the deaths from consumption in the different Grand Groups.

The areas of greatest phthisis mortality are the Pacific Ocean Region; the North Atlantic Coast; the Ohio River Belt; the North-Eastern Plateau; the Central Plains of Kentucky and Tennessee (Indiana is little affected); the Middle Atlantic Coast, and the Interior Plateau. The regions where consumption is least fatal are the Western Plains, comprising West Texas, Kansas, Nebraska, and Western Dakota; the Cordilleran Region; the South Atlantic Coast, and the South Mississippi River Belt. The other regions occupy an intermediate position between these. If we define the areas of greatest and least prevalence, by reference to the more familiar State divisions, we find consumption to be very common along the coast of California, becoming somewhat less prevalent as we go northwards to Oregon and Washington Territory. Here it will be observed to be alike prevalent both in the cities and rural districts. In New England and throughout the coast region southwards, as far as Chesapeake Bay, phthisis is remarkably prevalent; and this prevalence cannot be ascribed entirely to the influence of the great cities, with which this part of the country is studded, for along the whole of the North and Middle Atlantic coasts, the rural mortality from phthisis is even higher than that of the cities. Whether this high rural mortality from consumption is to be ascribed to the insanitary conditions, so often met with in the smaller towns and villages which are included in the rural districts, or to climatic or other causes, I am unable to say.

Table showing for Rural Districts and Cities, with Distinction of Sex, and for White and Coloured, Irish and German Parentage, the Proportion of Deaths from Consumption in 1000 Deaths from known causes.

Grand Groups.	Rural.		Cities.		White.	Coloured.	Irish Parentage.	German Parentage.
	Male.	Female.	Male.	Female.				
1. North Atlantic Coast Region,	148·7	197·2	138·0	162·8	...	...	231·0	140·2
2. Middle Atlantic Coast Region,	136·2	168·5	136·8	148·0	140·9	175·1	212·6	147·3
3. South Atlantic Coast Region,	76·5	101·6	138·2	145·4	88·0	105·5	...	...
4. Gulf Coast Region,	96·0	100·9	151·2	153·2	115·8	120·6	...	...
5. North-Eastern Hills and Plateaus,	131·0	186·1	147·1	153·2	...	...	232·9	113·4
6. Central Appalachian Region,	99·7	136·9	123·7	146·7	...	...	183·7	143·2
7. Region of the Great Northern Lakes,	109·8	156·8	94·7	101·0	...	...	201·4	116·1
8. The Interior Plateau,	116·0	166·6	142·3	160·4	138·4	176·7	171·0	165·0
9. Southern Central Appalachian Region,	101·5	171·0	...	...	124·3	179·3	...	...
10. The Ohio River Belt,	137·1	195·6	125·0	151·0	150·7	238·1	179·6	137·9
11. Southern Interior Plateau,	69·0	116·5	...	...	83·3	100·4	...	...
12. South Mississippi River Belt,	80·3	115·7	...	...	81·1	108·8	...	...
13. North Mississippi River Belt,	91·5	125·3	116·9	118·8	...	...	145·5	100·2
14. South-West Central Region,	59·6	84·4	...	...	70·3	77·0	...	...
15. Central Region Plains and Prairies,	115·4	180·4	131·0	155·3	136·8	221·4	...	...
16. The Prairie Region,	91·1	122·0	...	...	...	...	140·2	81·5
17. Missouri River Belt,	83·9	121·4	84·7	121·3	...	...	140·7	80·1
18. Region of the Western Plains,	69·8	68·2	145·8	110·5	...	...	51·9	42·2
19. Heavily-timbered Region of the North-West,	118·2	139·1	...	...	...	...	175·2	101·4
20. Cordilleran Region,	78·8	85·6	...	...	...	...	107·9	144·8
21. Pacific Coast Region,	155·9	184·1	170·4	139·8	...	...	146·0	113·9
Total,	101·9	146·6	131·9	144·3	126·2	139·1	198·4	123·6

The Ohio Valley, the western part of Kentucky, and the central part of Tennessee, are also to be reckoned amongst the severely affected regions. Amongst those districts in which consumption is prevalent in a less, but still marked degree, are to be included the States of Ohio and Michigan (except those parts bordering immediately on the lakes, which are only slightly affected), and the north-west districts of New York, the northern portion of Minnesota, and the eastern parts of Dakota and Colorado. Along the Gulf coast the mortality from phthisis is not very considerable, and here, as in Minnesota and Colorado, the mortality is increased by the deaths of invalids who resort thither on account of its supposed advantages of climate.

Western Georgia, Central Alabama, Texas, Arkansas, Kansas, and the Cordilleran Region generally enjoy a comparative immunity from phthisis. The Appalachian range is less affected than the country lying on either side of it; but this region must rank along with Indiana, Illinois, Iowa, Wisconsin, Missouri, and Mississippi, among the moderately affected districts.

Such being the distribution of phthisis, let us inquire whether it casts any light upon the conditions which favour or hinder its prevalence in the United States.

It will have been observed that, upon the whole, phthisis is more prevalent in the north than in the south of the States. This suggests the question whether the mean temperature, as roughly indicated by latitude, has any influence on the prevalence of consumption. In order to eliminate, as far as possible, the disturbing element of altitude, we shall, in the meantime, confine our attention to the Coast Regions and the Central Valley.

A reference to the table given above will show that phthisis diminishes in fatality gradually and steadily from north to south along the Atlantic coast, in the rural districts. In the cities, on the other hand, this relation is not constant. The following are the death-rates from consumption per 10,000 living in five Atlantic cities arranged in order from north to south:—Boston, 33·37; New York, 35·56; Philadelphia, 31·59; Richmond, 41·66; Charleston, 49·21. If the increasing mean temperature were the cause of the diminishing mortality in the rural districts as we advance towards the south, why should it not equally tend to reduce the prevalence of phthisis in the large towns? When we pass to the still warmer regions lying along the Gulf of Mexico, phthisis is found to be more prevalent than along the South Atlantic coast; and here it increases in intensity from east to west. The mean temperature of the Gulf coast is higher than that of the

South Atlantic coast, and that of the west is higher than that of the east.

The explanation of the higher degree of prevalence of consumption on the Gulf coast compared with the South Atlantic coast is not to be found in the greater preponderance of the negro element in the former, for the negro forms quite as large an element in the population of the South Atlantic as in that of the Gulf States. On the Pacific coast, consumption is more prevalent in the warmer regions of the south than in the north. Nor does the distribution of consumption in the central valley indicate a regular decrease in the prevalence of phthisis from north to south, such as we should expect to find if a low mean temperature favoured the prevalence of the disease. Arkansas, it is true, is remarkably free from the disease; but, on the other hand, the Southern State of Mississippi suffers quite as much as, or even more than Wisconsin. The cities in the Central Valley, again, exhibit augmenting death-rates from consumption from north to south, possibly from the greater proportion in them of the coloured race. Thus at St. Paul, in Minnesota, the death-rate is 11·57 per 10,000 living; in Chicago, 16·75; in St. Louis, 22·93; and in New Orleans, 39·42. Drake gives the following table, showing the ratio of cases of phthisis in the army per 1000 of mean strength in certain regions in the Central Valley, which illustrates the same point, and indicates an increasing prevalence of phthisis from north to south:—

Six Upper Lake Posts, ...	7·1
Two Lower Lake Posts, . . .	5·0
Four North Inland Posts, . . .	6·2
Six South Inland Posts, . . .	8·8
Eight Gulf Posts, ...	9·0

All this points to the conclusion that the prevalence of phthisis in different regions of the United States is not affected in any constant way, far less determined, by mean temperature. Nor do high *ranges* of temperature, apart from other conditions, appear to affect the mortality from consumption. High ranges characterise the climate of the Cordilleran Region, which enjoys a notable immunity from the disease. But it may be remarked that the climate of this region is dry; the vicissitudes of the weather, although great, are not in proportion to the amplitude of the annual range, and the altitude is considerable,—a circumstance which, as we shall presently see, has a marked influence in diminishing the prevalence of phthisis.

It is difficult to determine the influence of humidity of air and soil in relation to the distribution of phthisis in the larger areas in the States, even although its influence in particular localities may be clear enough. The climate of the Pacific coast is characterised by great humidity, and here consumption attains its maximum prevalence. The North and Middle Atlantic Regions, where consumption is so common, have by no means a dry climate or soil. On the other hand, if great moisture of soil and air form important factors in determining the prevalence of consumption, we should have expected to find it to be as common as it is rare on the shores of the great lakes and in the South Mississippi Belt; unless, indeed, its rarity in this latter region be owing to the antagonistic influence of malaria. Dr. Bowditch, of Boston, according to Hirsch, has shown that in certain of the New England States, those localities in which the soil is most humid are those that count the greatest number of victims from consumption, and the number of cases is found to be in direct ratio to the dampness of the soil.

But if these elements, taken singly, appear to have little or no influence on the geographical distribution of phthisis, it must not be inferred that combinations of these, which go to constitute a climate, are of equally little etiological significance. Cold, and atmospheric humidity, combined with sudden, rather than great, fluctuations of temperature, probably tend in some degree to determine the prevalence of phthisis in a given locality. In keeping with this, we find a general correspondence between the distribution of phthisis and that of bronchitis. In thirteen out of the twenty-one areas into which the country is divided, the deaths from phthisis and bronchitis are either together above or together below the mean for the United States as a whole. Thus, in the North and Middle Atlantic and the Pacific Coast areas, and in the Ohio Belt, the mortality from both diseases is above the mean; while in the South Mississippi Belt, the Western Plains, the South Atlantic Coast, and the Cordilleras, the deaths from both are below the average. The correspondence, as we have said, is not complete, but general; yet it is sufficiently marked to suggest the inference that the conditions that favour the prevalence of bronchitis favour also that of phthisis. Without ignoring the specific nature of phthisis, it is reasonable to suppose that constant bronchial irritation, resulting from climatic or other influences, predispose the lungs to phthisical infection. The old doctrine that consumption is the result of a neglected cold, may, in many instances, be founded on fact.

The effect of the comparatively high altitudes of the Western Plains and of the Cordilleran table-lands in reducing the mortality from phthisis, may be traced in the figures relating to these regions. The nature of the influence, however, which altitude exerts is by no means clear. Hirsch suggests that the effect of breathing a rarefied atmosphere is to increase the number and depth of the inspirations, and that the constant practice of this kind of 'pulmonary gymnastics' tends to increase the vigour and the disease-resisting power of the lungs. The constant out-door life, which is favoured by some mountain climates, probably counts for much in diminishing the prevalence of consumption at high altitudes; for the influence of altitude cannot be disassociated from the climatic conditions peculiar to high elevations—the dry air, dry soil, the clear sunny sky, the sparser population, and the social circumstances of the inhabitants. There are not wanting instances of localities at high elevations where consumption is abundantly common.

Without in any way calling in question the influence of high altitudes in diminishing the frequency of phthisis,—a point which may be looked upon as settled by observations in many countries, although in a less absolute way than some suppose,—it may not be out of place to recall a fact in geographical pathology that is rather being overlooked at the present day, viz. that low-lying regions, such as the South Mississippi Belt and the South Carolina Coast, may enjoy almost as great an immunity from consumption as habitable high altitudes. These are no solitary examples, for we meet in various parts of the globe with extensive areas, such as the coasts of Sumatra and the inland districts of Lower Egypt, little elevated above the sea-level, in which phthisis is rare—the former malarious and the other not.

Boudin's doctrine of an antagonism or mutual exclusiveness between malaria and phthisis, if capable of statistical confirmation or refutation, should find such in the United States, where both diseases are so extensively prevalent. Lombard has given the subject a careful consideration, and has stated his conclusions thus: "Là où règne la malaria, les phthisiques sont peu nombreux, et là où elle n'existe qu'à un faible degré, les phthisiques sont en grand nombre." He then asks the question whether it is the climate or the malaria that diminishes the consumption death-rate in those localities where it is at its minimum. In order to answer this question, he compares the States of Alabama, Mississippi, and Louisiana on the one hand, with Florida, Arkansas, and West Texas on the other. He finds that malaria is considerably less fatal, and the phthisical mortality higher, in the former than in the latter group of States, in which a higher malarial death-rate is associated with a lower mortality from consumption. He argues that as the temperature of these States is alike warm, the difference in their liability to phthisis is only explicable by the greater or lesser degree in which they are subject to the malarious influence. But the objections to the method he adopts are evident, for the climates of these States differ greatly. Florida and Arkansas are warm regions, it is true, but in rainfall, humidity, and range of temperature they differ widely. West Texas is a region which has little in common with the other States in respect to climate, and, besides, the returns from it are very unreliable. Nor is his reasoning entirely conclusive, for many other circumstances, besides temperature and malaria, have an undoubted influence on the prevalence of phthisis. We think it therefore desirable to examine the subject anew, with the aid of the data furnished by the Census Report of 1880.

Dr. Billings remarks very justly that "in a general way it may be said that where the proportion of deaths from enteric fever, from cancer, or from consumption is highest, there the proportion of deaths from malarial fever is lowest, and *vice versa*." This, so far as consumption is concerned, is evidently the result, first, of the comparative absence of malaria from the Northern States, such as New England, where consumption is specially prevalent; and secondly, of the comparatively small extent to which consumption prevails in a belt of country extending through the western part of Georgia, the middle portion of Alabama, the greater part of Mississippi, Louisiana, and Arkansas,—States in which malaria is very prevalent. These States constitute the major part of the Grand Group, designated "the Southern Plateau," and the eastern portion of the "South-West Central Plains," in both of which consumption is rare.

Now, it is evident that the region not immediately bordering the Gulf, but stretching in a belt parallel to the coast, north of parallel 31° and south of parallel 35° (with the exception of a small wedge of North Alabama coming down to near 33° N. lat.), is at once the chief seat of malaria, and at the same time a region in which phthisis causes a low mortality. But, in order the better to trace the relation between the two diseases, I have calculated for eight of the Southern States in which malaria is most prevalent, and for the several smaller groups of counties into which each State is divided, the ratio of deaths from consumption and malarial fever to the total deaths, and also the death-rate from the two diseases per 1000 living. The death-rate cannot be considered as accurate, for there is no certainty that the total deaths from either disease is registered, or rather, it is certain that the total deaths have not been registered; yet the figures have this value, that they show, within a certain margin of error, the *relative* death-rates of the two diseases in the several States dealt with. Perhaps, upon the whole, the ratio of deaths to the total mortality may be the more reliable method of the two, but the death-rates are of some value as a check upon the lethal-rates. There is one error inherent in the method of estimating the prevalence of a disease by the proportion of deaths which it causes to the total deaths, viz. that an unusual number of deaths from any given disease reduces the proportion of deaths from all other causes. Thus, if a large number of deaths is returned in any given district from malarial fever, the proportion of deaths from consumption will be relatively smaller, although the deaths may be larger in respect to the number living than in another district in which consumption bears a larger proportion to the total mortality. Wherever it is possible to obtain an accurate basis of population, and a fairly accurate return of the causes of death amongst that population, the most reliable measure of the prevalence of a fatal disease is that afforded by the deaths it causes to any convenient unit of the numbers living, provided always that the society is normally constituted. Having to do here not so much with the actual, as with the relative mortality caused by phthisis and malaria, the two modes of computation have considerable value, except in two small groups marked with an asterisk, in both of which the population is too small to afford reliable ratios, and in one of which it is abnormally constituted as regards the proportion of ages represented. The registration cities are excluded, and deaths from unknown causes have been eliminated before determining the ratios.

TABLES SHOWING THE RELATIVE MORTALITY FROM MALARIAL FEVER AND CONSUMPTION IN EIGHT STATES AND STATE GROUPS.

	ALABAMA.				MISSISSIPPI.			
	Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.		Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.	
	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.
State, . .	81·1	104·7	1·04	1·34	79·2	96·9	0·91	1·11
Group I., .	57·1	160·3	0·99	2·79	*24·4	158·5	0·18	1·18
Group II., .	59·5	149·1	0·84	2·12	68·9	97·9	0·78	1·12
Group III., .	94·0	77·5	1·13	0·93	111·6	90·9	1·35	1·10

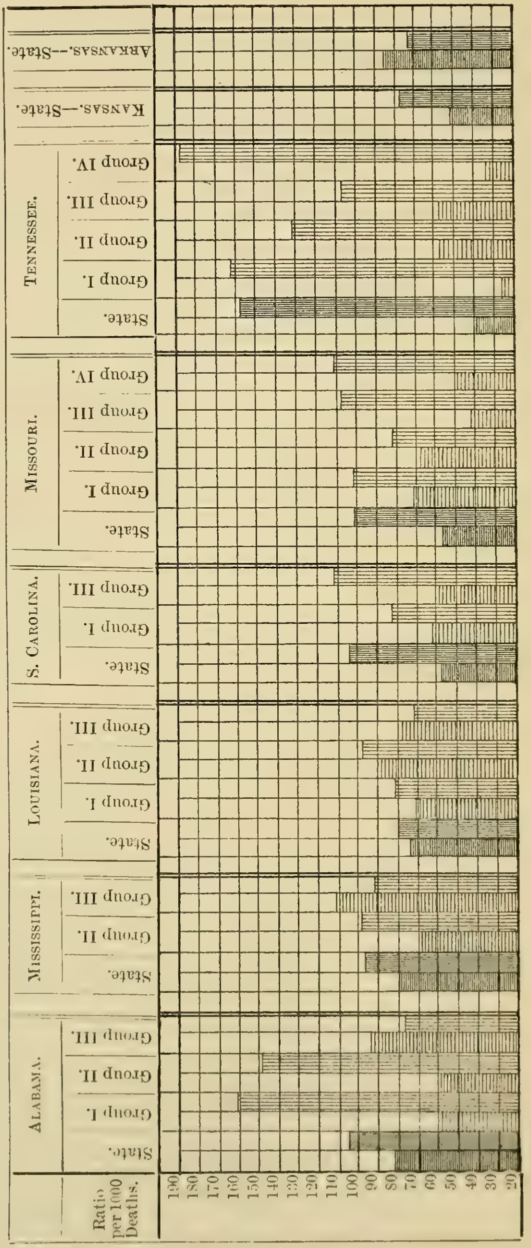
Tables showing the Relative Mortality, etc.—*continued.*

	Louisiana.				South Carolina.			
	Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.		Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.	
	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.
State, . .	74·9	80·0	0·85	0·91	57·2	104·1	0·75	1·37
Group I., .	70·2	81·0	0·82	0·94	62·2	85·1	0·77	1·06
Group II., .	86·7	95·6	0·94	1·04	*24·3	86·8	0·23	0·81
Group III.,	75·7	71·7	0·86	0·82	56·35	110·9	0·77	1·50

	Missouri.				Kansas.			
	Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.		Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.	
	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.
State, . .	57·4	100·2	0·88	1·54	50·5	77·7	0·72	1·12
Group I., .	70·8	101·5	1·23	1·76	52·84	78·2	0·76	1·13
Group II., .	67·05	82·9	0·95	1·18	33·3	74·8	0·44	1·00
Group III.,	42·9	108·9	0·63	1·61				
Group IV., .	49·2	111·0	0·80	1·80				

	Tennessee.				Arkansas.			
	Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.		Ratio per 1000 Deaths from all causes.		Death-rate per 1000 living.	
	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.	Malarial Fever.	Consumption.
State, . .	39·43	157·6	0·60	2·42	86·1	72·97	1·40	1·18
Group I., .	25·2	165·1	0·33	2·17	96·6	80·40	1·68	1·40
Group II., .	57·0	130·5	0·92	2·12	83·97	71·31	1·34	1·14
Group III.,	55·6	106·8	1·23	2·37				
Group IV., .	34·8	188·2	0·52	2·85				

The relation between phthisis and malaria in these States and groups will be more readily understood by reference to the following diagram, in which the transverse shading indicates malarial fever, and the vertical consumption:—



Confining our attention for the moment to the States, and not to the smaller groups included in each State, it will be seen that, as a rule, the mortality from consumption and malarial fever stand to each other in an inverse relation. The average ratio of deaths from malarial fever to the total deaths from all causes for the eight States is 66 per 1000; that from phthisis is 99 per 1000. In six out of the eight States in which the ratio of deaths from malarial fever is above or below 66, the ratio from consumption is inversely below or above 99 per 1000. The two States in which a high or low ratio of deaths from malarial fever corresponds with a high or low ratio from consumption are Alabama and Kansas; and in regard to the former it will be noted that it is just the group in which the mortality from malaria is high that the ratio of deaths from consumption is low.

When we look at the smaller groups of counties in each State, the inverse relation will be observed to obtain in the case of groups 1 and 2, as compared with group 3 in Alabama. In Mississippi, group 3 has a notably higher ratio of deaths from malaria than group 2, and the ratio from consumption is lower, although not proportionally so. In Louisiana the relation between the malarial and the phthisical deaths in the various groups is direct; group 2, with the highest ratio of deaths from malarial fever, presenting the highest ratio from consumption; yet the inverse relation holds good as between groups 1 and 3. South Carolina shows an inverse ratio between these diseases in groups 1 and 3. Missouri presents a somewhat dubious record. It will be seen that groups 3 and 4, in which malaria is least fatal, are those in which consumption is most fatal, and so far it may be claimed as an instance of the inverse relation; but it must be pointed out that group 1, with the highest ratio of deaths from malaria, has also a high ratio of deaths from consumption. In Kansas and Arkansas the relation between the groups is direct. In Tennessee, groups 1 and 4 have the lowest ratios from malarial fever and the highest from consumption. The groups in which the highest proportion of deaths from malarial fever is observed, being those in which the smallest proportion of deaths from consumption occur, and *vice versa*. So much for the ratios which the deaths from these diseases bear to each other.

The death-rates from malarial fever and consumption will be seen to correspond pretty closely with the ratios which the deaths from these diseases respectively bear to the total deaths,—the ratios and death-rates rising and falling together, although not always in the same proportion.

Without entering into details, it will be seen from a comparison of the death-rates from consumption and malarial fever in the different States, and in the several groups of counties in individual States, that the same rule of an inverse relation between malaria and consumption holds good, although not in so marked a degree, as when we deal with the ratios, and that the rule is not without exceptions in either case. In the case of five of the States, taking the death-rates as the standard, the relation is inverse, in two direct, and in one doubtful.

On the Pacific coast, we met with another notable instance in which the prevalence of consumption bears an inverse relation to that of malarial fever. The whole of this region is remarkably free from malaria, and it is throughout its whole extent severely affected with phthisis. Malaria is somewhat more severe in the north of this region than in the south; and it is in the north, viz. in Oregon and Washington Territory, that consumption causes a less proportion of deaths than in the region generally. In the North Mississippi Belt, the deaths from malarial fever are above, while those from consumption are below the average; but here the appearance of antagonism ceases, for while malarial fever becomes rarer as we go north, there does not seem to be any increase in consumption towards the north. Whether, therefore, we look at the relation of the two diseases in that large belt stretching from Georgia to Arkansas, as compared to the country generally, or in the individual States comprised in that belt compared with each other, or in the different districts of particular States, we shall find that, as a general rule, those regions, States, and districts in which malaria is most intense, are those that suffer least from consumption. That this inverse relation is entirely explained by climate, is negatived by the fact that it is observed in different parts of the same State, where the climatic conditions cannot be supposed to be widely different; and that the cities in the Southern States, which suffer in a much smaller degree from malaria than the districts in which they are situated, show unusually high death-rates from consumption. The facts, therefore, seem to establish two of the conclusions arrived at by Lombard—(1) that consumptives are less numerous in those districts where malaria is dominant than in those where it is less prevalent; (2) that this inverse relation is not entirely explained by differences of climate. The third conclusion, viz. that it is the malarious influence which diminishes the phthisical mortality, is at least open to doubt. The facts only show that there exist conditions in certain of the malarious regions of the States which are opposed to a high mortality from consumption.

No doubt, if we exclude climate, as we have done, the most obvious condition is malaria; but we should still have to eliminate the influences of soil, of race, of social condition, including occupation and habits of life, and some other unknown factor or factors, such as determine the distribution of consumption in England, Norway, and Germany, before we could ascribe with absolute certainty the low death-rate from consumption to the prevalence of malaria. We should also in this as in all such inquiries, have to account for the exceptions, and such exceptions do exist. We are the less disposed to admit an antagonism between the two diseases, that in many countries where malaria is prevalent phthisis is also extremely fatal. We have seen, for example, that phthisis causes a larger proportion of deaths in the Netherlands and in Italy, both of which are malarious than in England, where ague is the rarest of diseases. Yet it is remarkable that in both of these countries it is just the most malarious districts or provinces that suffer least from consumption. In the United States, we have an example of an extensive malarious region, in which phthisis is not only less prevalent than in the non-malarious districts of the north, but is also less prevalent than in England; and here, again, the inverse relation between the two diseases observed in Italy and Holland obtains. But even admitting that the low death-rate from consumption is determined in some way by the intensity of malaria, the relation is not necessarily one of antagonism.

It is, at least, a possible explanation of the apparently conflicting facts to which we have alluded, that those who are weakly and who are constitutionally most liable to consumption, are just those who most readily succumb to malaria. As malaria is most fatal to ages under 10, while consumption affects those between 20 and 25, it would follow on this hypothesis that malaria destroys in advance those that, but for its intervention, would later on have fallen victims to consumption; so that the inverse relation between the fatality from the two diseases, instead of proving an antagonism, would prove the reverse. Without putting great stress upon this theory, it seems to be the one which best explains the facts of the distribution of the two diseases in America and other malarious countries, but would not apply to the incidence of the disease in particular districts of non-malarious countries.

Bronchitis holds a very subordinate place in the pathology of the United States. In 1880 it was reported to have caused 1451 per 100,000 of deaths from all causes, whereas in England the proportion, for the ten years ending 1879, was 10,586. Taking the population as the measure of comparison, we find that in the United

States the death-rate per 100,000 living was 15·5 for the rural and 56·1 for the cities,—another proof of what we have so often insisted upon, viz. that impure air and other circumstances connected with city life have a vastly greater influence than temperature on the prevalence of this disease. Bronchitis is more fatal among the white than among the coloured population, and to those of Irish than those of German parentage. It is more fatal in infancy and old age than at any of the intermediate age periods.

The Middle Atlantic Region is that in which the greatest proportion of deaths from bronchitis occurs. The proportion is also high in New England; in the Ohio and Missouri River Belts; along the shores of Lakes Erie, Huron, and Michigan. The regions in which the mortality from bronchitis is low are the South Atlantic Coast, the South Mississippi Belt, the Western Plains, the Cordilleran Region, the central parts of Michigan, and the northern portions of Wisconsin and Minnesota. Bronchitis is more prevalent on the Gulf and Pacific coasts than in the adjacent countries inland.

Drake's tables show that catarrh, influenza, and bronchitis were most common in the army at the Lower Lake and North Inland Posts, and least so in the Upper Lake, South Inland, and Gulf Coast commands.

The months in which deaths from bronchitis attain their maximum are December and March. The proportion of cases each quarter in the army was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
119·8	72·7	48·7	99·6

Bronchitis is thus seen to be essentially a cold-weather disease.

Pneumonia, next to consumption, is the most fatal disease in the United States. In the census year, the proportion of deaths from pneumonia in 100,000 deaths from all causes was 8330, as compared with the English average, for the ten years ending 1879, of 4724 per 100,000. It is impossible to arrive at a satisfactory estimate of the death-rate per 1000 from this disease for the whole country. The aggregate number of deaths reported from pneumonia in the census year was 63,053, in a population of 50,155,783,[1] which gives a ratio of 1·25 per 1000 living; but this must, for reasons given when treating of consumption, be very considerably under the true number. It is alike difficult to explain the high mortality from pneumonia and the very low mortality from bronchitis in the United States as compared with England.

When we take the ratio of deaths to the total mortality from all causes as the standard, we find that in the United States pneumonia is more fatal in the country and small towns than in the cities, the proportion being 92·9 per 1000 for the rural districts, and 69·0 for the cities; but, unless some mistake has crept into the official returns, the relation is entirely reversed if the death-rate per 1000 living be taken. This is given at 1·22 for the rural districts, and 1·43 for the cities.[1] In England, and indeed in most parts of the world, so far as I know, pneumonia is more fatal in towns than in the country; and if we can trust to the death-rate as given in the returns, the same rule will also hold good for the United States.

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[1] *Census Report*, part ii. p. 390.

The doubt which I have expressed arises from the very complete reversal of the proportions between the rural and city mortality according as we take the ratio of deaths from pneumonia to the total mortality or the assigned death-rate per 1000 living. There can be no doubt that the ratio of deaths from pneumonia to the total deaths, showing a preponderance of mortality in the rural districts, is correct, and the death-rate perhaps is also so, but I do not have the means of checking it.

The influence of *sex* on the mortality from pneumonia, although well marked in the States, is not so decided as in England. The proportions are 1287 males to 1000 females in the United States; whereas in England, in 1884, the ratio was 1449 males to 1000 females. The ratio in Prussia, for the year 1887, was 1259 males to 1000 females; from which it appears that the difference in liability of the sexes is less in Prussia than in the States. In all countries for which we have statistics, males suffer to a greater extent from pneumonia than females, although the deaths in proportion to cases is higher in females than in males.

In respect to sex liability, pneumonia presents a strong contrast to phthisis, which affects females to a much greater extent than males.

Race has also an important influence on the mortality from pneumonia. The proportion of deaths in the census year was 105·5 of the coloured to 82·5 of the white population. I think it is a general rule throughout the world, as well in warm as in temperate countries, that the coloured race is specially liable to pneumonia.

The table on the following page shows the prevalence of pneumonia in the different Grand Groups.

If we examine this table by the aid of the map showing the situation of the Grand Groups, it will be seen that, while no part of the country is free from pneumonia, there are certain well-

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[1] *Census Report*, part ii. p. xxiii.

Table showing for Rural Districts and Cities, with Distinction of Sex, and for White and Coloured, Irish and German Parentage, the Proportion of Deaths from Pneumonia in 1000 Deaths from known causes.

Grand Groups.	Rural.		Cities.		White.	Coloured.	Irish Parentage.	German Parentage.
	Male.	Females.	Male.	Female.				
1. North Atlantic Coast,	75·0	73·6	75·9	76·8	...	...	86·9	70·9
2. Middle Atlantic Coast,	86·0	74·1	77·9	70·7	74·7	86·9	86·7	81·6
3. South Atlantic Coast,	88·3	63·6	44·7	33·5	59·1	81·7	...	...
4. Gulf Coast Region,	90·1	71·6	54·1	52·0	59·7	86·2	...	...
5. North-Eastern Hills and Plateaus,	83·3	75·9	89·5	96·1	...	...	90·0	51·5
6. Central Appalachian Region,	83·7	77·4	85·4	65·9	...	...	77·3	73·4
7. Region of the Great Northern Lakes,	77·9	60·5	58·1	56·6	...	...	70·4	69·5
8. The Interior Plateau,	80·9	73·5	58·1	57·2	68·2	88·2	82·4	71·7
9. Southern Central Appalachian Region,	80·6	73·8	...	...	68·0	107·2	...	...
10. The Ohio River Belt,	84·4	66·6	69·6	74·1	73·1	92·8	68·4	73·8
11. Southern Interior Plateau,	122·3	100·3	...	...	99·8	119·8	...	...
12. South Mississippi River Belt,	139·9	102·8	...	...	118·4	126·5	...	...
13. North Mississippi River Belt,	132·4	112·4	74·4	67·0	...	...	127·7	119·4
14. South-West Central Region,	152·8	111·4	...	...	129·8	146·1	...	...
15. Central Region, Plains and Prairies,	106·5	78·9	76·3	70·5	91·3	95·2	...	...
16. The Prairie Region,	112·8	85·2	...	...	...	...	109·6	79·8
17. Missouri River Belt,	164·3	119·0	166·6	113·9	...	...	176·5	160·2
18. Region of the Western Plains,	101·3	76·3	170·1	99·4	...	...	220·8	105·6
19. Heavily-timbered Region of the North-West,	67·0	41·5	...	...	...	...	68·6	46·5
20. Cordilleran Region,	150·0	106·8	...	...	...	...	192·1	148·4
21. Pacific Coast Region,	60·6	64·2	83·8	70·2	...	...	83·8	53·0
Total,	102·4	82·9	71·1	66·6	82·5	105·5	89·1	82·1

defined regions in which it is rare, and others in which it is in great excess. Pneumonia is notably rare along the Atlantic, Gulf, and Pacific coasts, and also in a strip of country bordering on Lakes Ontario and Erie, and in the whole of the peninsular State of Michigan. So well marked, indeed, is the exemption of the sea and lake coasts from pneumonia, that we are compelled to conclude that in the United States, at least, proximity to large bodies of water tends to reduce the prevalence and fatality of the disease. But it is not to be overlooked that some of the inland regions, such as the South Central Appalachian, the Interior Plateau, and the Heavily-timbered Region of the North-West, enjoy an equal, if not greater, immunity from pneumonia.

If we inquire into the influence which proximity to the sea exercises on the prevalence of pneumonia in other parts of the world, we are met with the difficulty that large commercial and manufacturing towns are, upon the whole, more common on the sea-board than in the interior, unduly increasing the mortality from the disease; and we do not generally have the means of eliminating this source of error.

Still, it will be found that in many countries the coast regions are comparatively exempt from pneumonia. The coast belt of Mexico at Vera Cruz, Tabasco, and Yucatan, for example, is little subject to the disease, which is there very seldom met with, except among the coloured population. Pneumonia is also stated to be rare along the coasts of Central America.

Norway, with its extensive coast line, its absence of large towns, and its trustworthy registration system, is specially favourable for the study of the influence of proximity to the ocean on the prevalence of pneumonia. In 1888, the deaths from pneumonia throughout the kingdom, with an estimated population, in 1885, of 1,975,000, numbered 1688, which gives a death-rate of 0·85 per 1000 living. The death rates of the individual provinces situated along the Atlantic coast, enumerating them from south to north, were—Stavanger, 0·69; South Bergenhus, 0·53; Bergen Town, 1·9; North Bergenhus, 0·57; Romsdal, 0·68; South Trondhjem, 0·54; North Trondhjem, 0·62; Nordland, 0·50; Tromsö, 0·55; Finmarken, 0·45. It will thus be seen that all the provinces situated along the Atlantic coast have death-rates from pneumonia below the average for the kingdom.

The coasts of the Skager-rack, on the other hand, are more severely affected than the country generally. The death-rates in the south-coast provinces for 1888 were as follows:—Lister and Mandal, 1·17; Nedenaes, 0·97; Jarlsberg-Laurvig, 1·0; Akerhus

1·1; Smaalenenes, 1·2; Christiania Town, 1·2. The ratios for the inland districts, for the same year, were—Buskerud, 0·87; Christians, 0·82; Hedemarken, 0·99. From this it may be inferred that proximity to the sea does not necessarily insure a low death-rate from pneumonia. Coast districts may even suffer to a greater extent than inland and elevated regions. It is only when other conditions, more or less frequently associated with proximity to seas or large lakes, are present that sea and lake coasts enjoy a comparative immunity from the disease.

Comparing the Baltic provinces of Prussia with those situated inland, I find that the ratio of deaths from pneumonia to the total mortality in 1887, in twelve coast provinces, including Gumbinnen, Marienwerder, Bromberg, and Lüneburg, which, although not quite along the shore, are not far removed from it, averaged 55·8 per 1000; while in twenty-one inland districts the ratio was 72·3. But the higher ratio which deaths from pneumonia bear to the total mortality in the inland, compared with the coast provinces, is mainly due to an excess of the disease in the districts of Münster, with a ratio of 121·9; of Hildesheim, Minden, and Osnabrück, with ratios of 92; of Arnsberg, with 117; and Kassel, with 99. All these are situated within an area nearly corresponding to Westphalia, in which pneumonia is excessively common, whereas the inland provinces in the east, such as Breslau and Oppeln, are even less subject to the disease than some of the coast districts. As it has already been pointed out under Germany, pneumonia is more common in the west than in the east; and this distribution overrides, so to speak, any difference that may exist between the coast and inland regions, so that I am at a loss to determine whether proximity to the coast has any influence on the distribution of the disease in Prussia.

In Belgium, Holland, and England, the influence of proximity to the coast is masked by the distribution of large manufacturing and commercial towns, by the presence of which, rather than by locality, the greater or lesser prevalence of the disease is determined. The same is pretty much the case also as regards France, although here, according to Lombard, the western departments suffer less from pneumonia than the eastern, which may perhaps be owing to the influence of proximity to the ocean on its prevalence. The coasts of Syria are only slightly affected, while the disease is prevalent inland.

On the East Coast of Africa and the coasts of Madagascar, pneumonia is comparatively rare. Pneumonia is also comparatively rare all along the shores of the Malayan Peninsula, of Cochin China, and the south of China.

It would not, however, be difficult to enumerate many extensive stretches of coast where pneumonia, if not more frequent than in the adjacent inland districts, is, at least, very prevalent.

The disease is far from rare on the West Coast of Africa and the adjoining islands.

The coast line of South America, particularly the coasts of Peru and Chili, are severely affected, the disease attaining perhaps its maximum at Valparaiso, where nearly one in five of the hospital deaths is caused by pneumonia.

This survey, imperfect as it is, suffices to show that coast regions do not always show a lesser prevalence of pneumonia than inland regions; and when they do so, it is not to the proximity to the water in itself, but the influence which large expanses of water exercises on the humidity of the soil and air, and its moderating and equalising effect on temperature, that reduces the prevalence of the disease. Where other conditions come into operation, rendering the climate variable, coast localities have no advantage over inland districts as regards the prevalence of pneumonia.

It was at one time generally held that pneumonia is most prevalent in northern latitudes, where the annual mean temperature is low. This error has now been abandoned, and it is even held by some that pneumonia increases in prevalence as we approach the equator, and as the mean temperature of a given region increases.

So far as I can judge, both views are erroneous. In an able paper on the "geographical and climatic relations of pneumonia," Sanders[1] endeavours to establish the existence of a direct relation between temperature and pneumonia, not only in the States, but in Europe, and generally throughout the world. As regards the States, he grounds his conclusions upon the census returns of 1860 and 1870, from an analysis of which he compiles the following table:—

TABLE SHOWING THE RELATION OF PNEUMONIA TO LATITUDE AND MEAN TEMPERATURE.

Latitude.	Mean Temperature.	Death-rate from Pneumonia per 1000 living.
29°–30°	70°–68°·8	1·267
30°–35°	68°·8–61°·7	1·914
35°–40°	61°·7–53°·1	1·288
40°–45°	53°·1–44°·9	1·072
45°–46°	44°·9–43°·4	0·847

According to this table, the mean temperature determines the prevalence of pneumonia in the United States, and the relation between mean temperature and the death-rate from pneumonia, if not a constant, is a direct one. It is impossible to criticise the figures, as the precise method on which the table has been constructed is not explained; but I shall examine the subject according to the distribution of pneumonia as given in the census returns of 1880. An examination of the table given on page 862, showing the distribution of pneumonia according to regions, supports the main conclusion arrived at by Sanders, that the disease is more prevalent in the Southern than in the Northern States. The principal areas in which pneumonia is in excess will be found to lie south of lat. 41°; but, on the other hand, it will be observed that to the south of this line there are several very extensive areas, such as the South Atlantic coast, the South Central Appalachian Region, the southern part of the Pacific coast, and a part of the Gulf coast, in all of which pneumonia is very rare. The existence of these extensive areas of minimum pneumonia prevalence in the south is sufficient proof that the relation between increase of mean temperature and pneumonia prevalence is not so uniform and precise as Sanders' table would lead us to believe.

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[1] *American Journal of Medical Science*, July 1882.

Referring to the Atlantic coast line, it will be seen that, as regards males, the ratio of deaths from pneumonia to the total rural mortality is 75·0 on the North Atlantic coast, 86·0 on the Middle Atlantic coast, 88·3 on the South Atlantic coast, and 90·1 on the Gulf coast. Here the disease increases as we advance to the south, and the increase is progressive. But this only holds good for males. The ratio of female deaths on the Gulf coast is less than on the North Atlantic coast. The increase even in the case of males is not very marked, and is not greater than might be expected from the larger proportion of the coloured population in the south. If we now turn our attention to the inland region corresponding to the Appalachian highlands, the asserted progressive increase in the prevalence of pneumonia from north to south is not observed. Pneumonia, on the contrary, is more prevalent in western New York and Pennsylvania than in West Virginia, or in the eastern districts of Tennessee, becoming more frequent, again, as we enter Georgia and Alabama. Nor, if we look at the figures which shall be given in a subsequent table (page 869), does it appear that on the Cordilleran table-land, pneumonia increases in frequency from north to south. Pneumonia, it is true, is less prevalent in the Northern States of Montana, Wyoming, and Idaho than in the more southerly States of Utah, Nevada, and Colorado; but it again diminishes in frequency when we advance to New Mexico and Arizona.

A table is given in the Census Report for 1880 (Part ii. page xxvi.) showing the death-rate from pneumonia of fifty cities in the Union, with populations ranging from 34,555 to 1,206,299. If there were a constant and progressive increase in the prevalence of pneumonia as the mean temperature increases, this should be seen in the pneumonic death-rates of these cities. In order to show how far the increasing mean temperature affects the fatality of the disease, I shall arrange the cities in their order from north to south; and, bearing in mind the influence of density of population, I shall classify them according to their population. To avoid all question of altitude, I deal only with the coast towns:—

Cities with over 300,000 Inhabitants.		Cities with from 100,000 to 300,000 Inhabitants.		Cities with less than 100,000 Inhabitants.		Cities with less than 100,000 Inhabitants.	
Boston, .	1·85	Providence, .	1·47	Lowell, .	1·38	Camden, .	1·03
New York, .	2·12	Newark, .	1·41	Cambridge, .	1·50	Wilmington,	1·27
Brooklyn, .	1·55	Jersey City, .	1·60	Worcester, .	1·95	Richmond, .	0·93
Philadelphia,	1·13	Washington, .	1·59	Hartford, .	1·16	Charleston, .	1·30
Baltimore, .	1·27			New Haven, .	0·85		

It is evident from the above table that there is no uniform relation to be traced between the latitude of a city and the death-rate from pneumonia which it exhibits. The greater prevalence of pneumonia in the larger cities as compared with those under 100,000 is, however, apparent.

We are not contending that pneumonia is more common in cold countries, or that it decreases in frequency as we approach the equator. A mere glance at the death-rates from the disease along the Atlantic coast of Norway will suffice to show the untenableness of such a view. The death-rate from pneumonia in Finmarken, within the confines of the Arctic circle, is less than at Stavanger. We have also shown that, in France, pneumonia and broncho-pneumonia increase in frequency towards the south. All this is true, but it does not prove that any uniform relation between an increasing mean temperature and an increasing prevalence of pneumonia obtains. If such relation exists, pneumonia should be exceedingly prevalent near the equator, which we know is not the case. In Ceylon, which lies between lat. 5° 55′ and 9° 51′, pneumonia is certainly less prevalent than in England or the United States. In Seychelles, which is only 4° from the equator, and for which we have reliable statistics, pneumonia gives rise to 10·45 per 1000 of the total deaths; whereas in the United States it reaches the proportion of 83·30 per 1000. In Singapore, which may be said to be placed on the line, with an equable and moist climate, pneumonia is exceedingly rare. In short, the doctrine that pneumonia increases in frequency as we advance towards the equator, and as the mean temperature increases, is just as little supported by facts as the older view that it increases as we advance towards the poles, and as the mean temperature diminishes. Mean temperature, other things being equal, has little influence on the prevalence of pneumonia.

The influence of altitude on the prevalence of pneumonia is another point which has given rise to controversy. Lombard contends that pneumonia is more frequent at high than at low altitudes. Sanders, in the paper already referred to, traverses this opinion, not only as respects the States, but as regards the world generally. The subject, therefore, deserves careful consideration.

We have already seen that pneumonia is comparatively rare along the coasts of the United States, and that it is also rare in the Appalachian highlands. This fact in itself indicates that the prevalence of pneumonia is not regulated solely by altitude. Indeed, if we were to admit, with Sanders, that a constant relation obtains between mean temperature and pneumonia prevalence, we should be warranted in excluding the uniform relation which he also claims to exist between pneumonia and altitude. The two relations are incompatible.

The following tables show (*a*) the death-rates from pneumonia in certain States along the coast; (*b*) in the elevated country in the Appalachian Region and Western Plains; and (*c*) in the Cordilleran Region. The States (not Grand Groups) are arranged from north to south so as to exhibit at the same time the latitudinal prevalence of pneumonia.

TABLE SHOWING POPULATION, DEATH-RATES, AND RATIO OF DEATHS FROM PNEUMONIA TO THE DEATHS FROM ALL CAUSES IN SIX COAST STATES.[1]

STATE.	Population.	Number of Deaths from Pneumonia.	Death-rate from Pneumonia.	Total Deaths from known causes.	Deaths from Pneumonia.	Ratio of Deaths from Pneumonia to Total Deaths.
Maine, . .	648,936	456	0·99	9,265	456	69·5
Connecticut, .	517,803	651	1·25	7,460	651	87·3
New Jersey, .	781,196	825	1·06	11,481	825	71·9
Delaware, . .	104,130	87	0·83	1,232	87	70·6
South Carolina,	945,593	1049	1·11	12,454	1049	84·2
Florida, . .	269,493	209	0·77	2,842	209	73·5

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[1] In this and the following tables, the registration cities are excluded, because some of them have been given separately, and also because the character of the industries carried on in large cities obscures the results. The deaths from unknown causes have been subtracted from the total deaths.

TABLE SHOWING POPULATION, DEATH-RATES, AND RATIO OF DEATHS FROM PNEUMONIA TO THE DEATHS FROM ALL CAUSES IN TWO STATES IN THE ELEVATED WESTERN PLAINS AND APPALACHIAN HIGHLANDS.

STATE.	Population.	Number of Deaths from Pneumonia.	Death-rate from Pneumonia.	Total Deaths from known causes.	Deaths from Pneumonia.	Ratio of Deaths from Pneumonia to Total Deaths.
Ohio, . .	2,642,315	2,083	0·79	30,813	2,083	67·6
West Virginia,	618,457	432	0·70	6,855	432	63·0

TABLE SHOWING POPULATION, DEATH-RATES, AND RATIO OF DEATHS FROM PNEUMONIA TO THE DEATHS FROM ALL CAUSES IN EIGHT STATES OR TERRITORIES IN THE CORDILLERAN REGION.

STATE.	Population.	Number of Deaths from Pneumonia.	Death-rate from Pneumonia.	Total Deaths from known causes.	Deaths from Pneumonia.	Ratio of Deaths from Pneumonia to Total Deaths.
Montana, .	39,159	32	0·82	307	32	104·2
Wyoming, .	20,789	17	0·81	186	17	91·3
Idaho, . .	32,610	35	1·07	314	35	111·4
Utah, . .	143,963	295	2·05	2,290	295	128·8
Nevada, . .	62,266	147	2·36	677	147	217·1
Colorado, .	158,698	373	2·35	195	373	191·2
New Mexico, .	119,565	160	1·34	2,165	160	73·9
Arizona, . .	40,440	30	0·74	271	30	110·7

The States of Ohio and West Virginia, although their elevation above the sea-level is very considerable, have, upon the whole, a lower death-rate from pneumonia than those situated along the coast line; for it will be observed that we have selected as far as possible those of the Atlantic States that lie along the coast, and are in no part of their extent much above the sea-level. This so far seems to favour the view advocated by Sanders, that pneumonia decreases according to altitude; but when we examine the table showing the death-rates from the disease in the Cordilleran Region, this view is seen to be quite inadmissible. If pneumonia is somewhat rarer in the States of Ohio and West Virginia at elevations of from 500 to 2000 feet than in the States along the Atlantic coast, the relation is reversed when we come to deal with elevations of from 3000 to 5000 feet, such as are met with in the Cordilleran table-land. If the death-rate from pneumonia is high in many of the States in the Cordilleran table-land, where the population is sparse, we may readily believe that if these elevated regions were densely peopled like the coast States, the pneumonic death-rate of these high altitudes, as compared with the coast line, would be higher than these figures indicate.

If we inquire into the relations of pneumonia to altitude in other countries, it will be found that pneumonia is often very prevalent at high altitudes just as in the United States. Thus we have the authority of Jourdanet for stating that pneumonia is very common and fatal on the plateau of Anahuac in Mexico. It is remarkably prevalent in the mountainous regions of Bolivia, Peru, and Chili. It is undoubtedly frequent in the hilly country of Syria and on the table-lands of Armenia, Arabia, and Iran, and along the North-West frontier of India. Lombard concludes from the experience of medical men acquainted with the country, that in Switzerland pneumonia increases in prevalence as we attain higher altitudes. He also gives an interesting table showing the comparative prevalence of acute lung diseases in the Caucasus at varying elevations from 50 up to 3300 feet, from which it may be inferred that acute lung diseases are more frequent in the Caucasus at higher than at lower elevations. We may also mention the greater prevalence of pneumonia on the table-land than on the coasts of Madagascar; and in the Upper Nile basin as compared with Lower Egypt.

Yet, while I think that pneumonia is, as a rule, more frequent at higher elevations, it is a rule to which there are many notable exceptions. Blanc, for example, testifies to the extreme rarity of the disease in Abyssinia; Pruner saw only two cases during his residence on the table-land of East Africa; and pneumonia is certainly somewhat rare in many parts of the Deccan at elevations of from 2000 to 4000 feet. The explanation of these apparent anomalies is to be sought for in the peculiarities of climate and soil peculiar to special localities. A study of the distribution of pneumonia seems to teach that altitude by itself has no constant relation to the prevalence of the disease.

Pneumonia is very distinctly a seasonal disease, the greatest mortality falling on the months of February, March, April, and May.

Typhoid Pneumonia has frequently been epidemic in the United States, sometimes confined to comparatively limited districts, at other times spreading over larger areas, and frequently extending over a series of years, either in scattered outbreaks, or in a more continuous manner, from one region to a contiguous one. The colder regions of the north have perhaps suffered from these outbreaks even less than the warmer climates of the south; but whether appearing in north or south, they have been most frequent in winter and spring. In a considerable number of instances, these epidemics have been peculiarly severe among bodies of people living together under the same conditions as in barracks and public institutions.

Pleurisy caused, in the year 1880, a ratio of 258 out of each 100,000 deaths—a proportion very nearly the same as that which obtains in England. It is more fatal among the coloured (3·7) than among the white population (2·7). Males and females die of pleurisy in nearly equal proportions. The disease is more fatal in the city than in the rural districts. Its areas of greatest prevalence are found in the rural districts of the Gulf and South Atlantic coasts.

Diseases of the Liver are stated to have caused a proportion of 8·9 per 1000 of the total deaths, and less than one-third of these are ascribed to inflammation and abscess. The military returns do not indicate any great prevalence of hepatitis in the States, but they show it to be slightly more prevalent in the south than in the north. In no part of the country can liver abscess be said to be endemic.

Diseases of the Spleen are somewhat common in the malarious districts.

Rheumatism is quite a common malady in the States, and, according to Lombard, it is more common in the south than in the north.

Heart Disease and *Dropsy*.—Heart disease gives rise to 36·21 per 1000 deaths from all causes, and dropsy to 20·54 per 1000; but these terms are too vague to permit a comparison with the proportions of deaths from the various forms of heart disease in other countries. Taking, however, the two diseases together, we observe that they are most fatal in the New England States and New York. They are also prevalent along the coasts of North and South Carolina, and in Florida and Alabama. It is probable that a considerable proportion of the deaths from dropsy in the Southern States are due to malaria. These diseases are more fatal in the rural than in the city districts, and females suffer in a somewhat larger proportion than males.

Convulsions caused a proportion of 24·79 per 1000 deaths in the census year; whereas in England, in 1884, the proportion was 43·4 per 1000 deaths from all causes. I have not examined into its distribution, but Lombard found that convulsions were nearly twice as fatal in the Northern as in the Southern States.

Tetanus and *Trismus Nascentium* gave rise to 335 in 100,000 deaths from all causes. The proportion of deaths from these diseases is higher in males than in females; very much higher in the cities than in the rural districts, and among the coloured than among the white population. The districts in which deaths from these diseases are most numerous are the South Atlantic and Gulf coasts; the South Mississippi River Belt, and the South-West Central Region. They are most fatal in the months from July to October,—August being the month in which most deaths occur. They are thus diseases of the warm season.

Scrofula and *Tabes Mesenterica* appear to be much less prevalent in the United States than in England. In the former the proportion of deaths from these causes was 661 per 100,000, and in the latter, for the ten years ending 1879, 2037. The proportion of deaths was greater in the rural districts than in the cities, and among the coloured than the white population. The South Central Appalachian and the Central Plains are the regions where these diseases are most frequent.

Cancer caused 17·26 per 1000 of the total mortality in the census year, as against the proportion in England (1884) of 28·62 per 1000. In fifty large cities in the States, the death-rate was for males 28·22 per 100,000 living, and for females 51·61; whereas the death-rate from cancer in England and Wales was 40·5 for males, and 70·7 for females. The disease is, taking the whole country, more common in the cities than in the rural districts; but there are numerous exceptions to this rule; especially in New England and the North-Eastern hill region, in both of which the rural districts suffer most. Hirsch informs us on the authority of Shattuck, that in the State of Massachusetts, on an average of nine years, 5·6 per 1000 of the deaths in Boston were due to cancer; but in the small towns and country districts the ratio was 12·3 per 1000 deaths. The white and coloured races suffer very unequally from cancer. In males the death-rate per 100,000 living is 20·54 for the white population, and 5·85 for the coloured; in females, 35·44 for the white, and 19·32 for the coloured. It is more frequent among the Irish and German immigrants than among the native white population. Cancer is specially prevalent in New England and along the southern part of the Pacific coast, and, again, in the extreme north of that coast, in the Washington Territory. It is also common, but in a less degree, in New York, Pennsylvania, and Ohio, in the interior of Michigan, and in the southern part of Wisconsin. It is least prevalent in the South Mississippi Belt, and the Southern States generally are affected to a smaller extent than the Northern States.

Leprosy exists, but not to any great extent, among the Scandinavian immigrants settled in Minnesota, Wisconsin, Iowa, and Nebraska. Fifteen cases in all have been noticed in Charleston, South Carolina, from 1847 to 1882. Leprosy made its appearance in Louisiana (where it was not uncommon during the last century) in 1866, in the case of a woman whose father came from the south of France. Five out of six of her children became lepers. A few cases of leprosy have been observed among the Chinese in California and Oregon. The total number of lepers throughout the Union is estimated by White at from fifty to a hundred.[1]

Frambœsia is common in the Southern States.

Goitre is endemic to a small extent at several points, mostly in the mountain valleys of the Appalachians, and more extensively in the upper basin of the Rio Grande del Norte, where cretinism is also met with.

THE INDIANS.

The Indians in the United States, including Alaska, are estimated by Greene (*Chambers's Encyclop.*) at 315,000; and this writer believes that, at the present day, they are slowly increasing in numbers. On the reservations their number, in the census year, was 78,521, among whom there were 1859 deaths reported—giving a death-rate of 23·6 per 1000, which is considered to be much under the actual death-rate. We shall notice a few points of interest in connection with the diseases to which this race is specially liable; but it is well to bear in mind that the Indian on a reservation is not an Indian in a state of nature.

Malarial Fever.—The Indian population suffers to a less extent from malarial fever than the negroes. This disease is far from rare among the nomad tribes (*Stat. Rept. Sickness and Mortality of the U. S. Army*, 1855–60, pp. 213 and 263).

Enteric Fever, if the returns can be trusted, is less frequent among the Indians than among the white and black races.

Diphtheria is moderately fatal among the Indian population on the reserves; whether it occurs among the wilder tribes, I know not.

Diarrhœal Diseases are excessively fatal among the Indians.

Smallpox has been terribly destructive to the Indian race. Dr. Moon was informed that the Snake Indians in Utah had been reduced during the thirty years preceding 1857 to a fourth of their original number by smallpox.

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[1] White, *American Journal of Med. Science*, Oct. 1882.

Smallpox is noticed by Dr. Heger as one of the prevalent diseases among the Yakamas in Washington Territory.

Measles is excessively fatal among the Indians on the reservations; but they suffer less than the white population from *Scarlet Fever*.

Consumption is a terrible scourge to the reservation Indian; the proportion of deaths from phthisis to the total mortality being 286·99 per 1000. Nor does the Indian living in a state of greater freedom appear to escape the malady, which is reported as being common among all the tribes. The females, as is the case among the white and black races, are more liable to the disease than the males.

Pneumonia is somewhat less fatal to the Indians than to the white and black races.

Syphilis was originally unknown among the American Indians, and up, at least, to 1856, there were still some tribes who had entirely escaped the disease. Keeney says that "in the neighbourhood of Fort Jones in California, *lues venerea* is unknown;" whereas, on the borders of Mexico it was decimating the race. Syphilis appears to act on the Indian constitution as an acute infective disease. Thus we read that the Apaches of New Mexico, in one of their expeditions, carried off some female captives from amongst the Mexican Sonoreans, who revenged their country's cause by communicating syphilis to their captors, which, we are told, "spread with fearful effects among their own people, who to get rid of the dreadful scourge . . . either abandoned the unfortunate victim to die of starvation, or, as in many instances, deprived him of life."[1] Venereal diseases are excessively fatal on the reservations; for, whereas the proportion of deaths from this class of diseases amongst the whites to the total deaths was 2·25, and amongst the blacks 4·14, it reached the enormous proportion of 34·87 amongst the Indians.

Scrofula is also uncommonly fatal among the Indian tribes, whether located on the reservations or living at large.

Rheumatic Diseases are reported as frequent among the tribes of the West, but we hear nothing of the occurrence of rheumatic fever amongst them.

Cancer is a very rare disease among the Indians.

The following diagram from Billing's Report on the Mortality and Vital Statistics of the United States—a number of the less important diseases having been omitted—will exhibit the influence of race on the prevalence of disease in the United States more clearly than description:—

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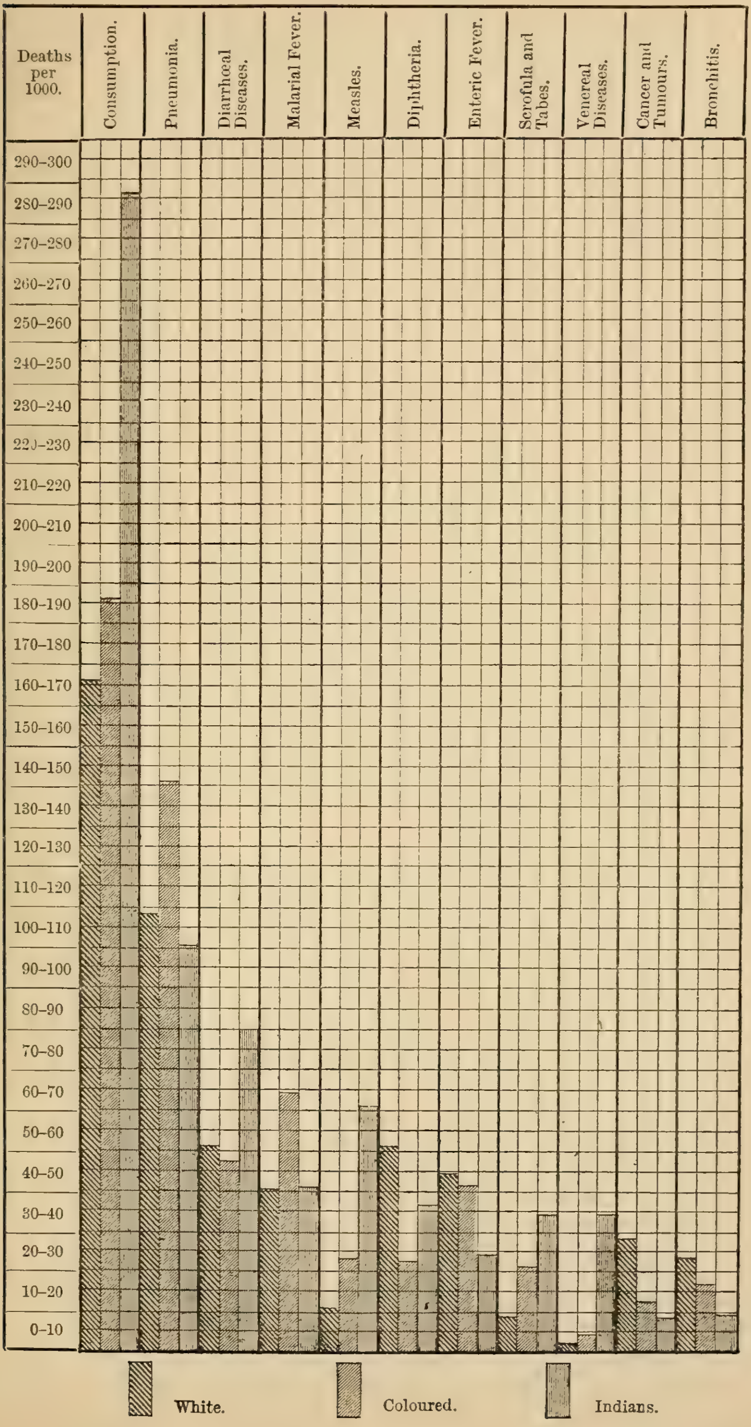
[1] *Stat. Rept. U. S. Army*, 1860, p. 214.

Diagram showing for Whites, Coloured, and Indians, the Proportion of Deaths from Specified Diseases in 1000 Deaths from known causes.



CHAPTER IV.

MEXICO.

Geography and Climate.—Mexico occupies the southern extremity of the North American continent, stretching from the United States on the north to Guatemala and Belize, in Central America, on the south, and from the Gulf of Mexico on the east to the Pacific on the west. It comprises twenty-seven States and two Territories, having an area of 751,177 square miles, with a population which was estimated in 1889 at 10,447,974.

This region, as regards altitude, is usually divided into three zones. The *tierras calientes*, or warm zone; the *tierras templadas*, or temperate zone; and the *tierras frias*, or cold zone. The *tierras calientes* comprise the low flat coast-lands, and the lower parts of the slopes of the hills, up to a height of about 2500 feet. The coast line on the Atlantic consists in great part of low sandhills or dunes, stretching along the shore at a greater or lesser distance inland. Large tracts become covered with water during the rains. The temperature and rainfall of Vera Cruz in this zone, on the west coast, are as follows:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature,	21·72	22·61	23·28	25·72	27·61	27·0	27·50	27·50	27·61	26·22	24·0	22·22
Rainfall, .	13·5	19·9	6·8	Inap.	105·6	270·3	364·5	...	145·1	490·4	99·7	45·8

Strong north winds prevail in October and November, and are supposed to mitigate the violence of yellow fever. The *tierras templadas*, or temperate zone, extends from 2500 to 4500 or 5000 feet above the sea-level. Wherever water exists, the country is covered with a rich vegetation. The mean temperature is from 18° to 24° C. The *tierras frias*, or cold zone, comprise the great central plateau of Anahuac, which is formed by an expansion of the Cordilleras of Central America, running up to Santa Fé in New Mexico. This plateau has an altitude of from 5000 to 9000 feet, and on the west presents a steep face to the Pacific, while on the east it slopes more gradually in terraces to the Atlantic. The mean temperature of this region varies, of course, very considerably, both in respect to altitude and latitude.

The following gives the average rainfall for the three years 1878, 1879, and 1881, as well as the temperature of the city of Mexico, which may be taken as representing the cold zone:—

Months.	1878.	1879.	1881.	Average Rainfall 1878, 1879, 1881.	Mean Temp.
	mm.	mm.	mm.		°
January, ...	5·2	9·4	19·9	11·5	11·39
February, ...	0·6	0·5	6·5	2·5	12·34
March, ...	2·1	6·8	0·7	3·2	16·22
April, ...	Inap.	2·9	12·2	5·0	17·22
May, ...	78·9	40·4	112·8	77·3	19·00
June, ...	70·7	134·2	90·6	98·5	18·56
July, ...	197·0	65·6	138·7	133·7	18·44
August, ...	345·6	128·5	101·0	191·7	18·33
September, . . .	136·8	56·4	58·0	83·7	17·94
October, ...	54·9	32·5	34·0	40·4	15·67
November, . . .	0·2	Inap.	20·9	7·0	13·22
December, . . .	0·6	...	Inap.	0·2	11·17
Totals, . . .	892·6	477·2	595·3	654·7	15·79

The daily range of temperature is considerable. The thermometer may stand during the day at 16° C. and fall during the night to 1° or 2° C.

The configuration of the plateau, which is slightly depressed towards the centre, prevents drainage; and certain districts tend to become marshy during the rainy season, although the soil generally dries very rapidly. This plateau, for the same reason, presents numerous lakes, which seem at a former period to have been of much greater extent than at present. Of the valley of Mexico itself Bullock remarks, "A large portion of it is neither land nor water, but an unsightly expanse of marsh and bog" (*Across Mexico, Land and Sea*, 1861).

THE TORRID AND TEMPERATE ZONES.

Pathology.—*Malaria.*—Beginning with the torrid zone (*tierras calientes*), on the Atlantic coast, the best known town is Vera Cruz. Although it has only from 10,000 to 12,000 inhabitants, it is the chief port of Mexico, the resort of sailors and foreign traders. It is situated in lat. 19° 12′ N., long. 96° W. The site is level, and the soil of sand and clay, covered with humus. Four or five feet below the surface, salt water is reached. About a mile to the west of the town a range of sand dunes are seen running from north to south, and beyond these are marshy plains partially submerged during the rains. Between these dunes and the town water stands in pools during the rainy season.[1] The sanitation of the town leaves much to be desired. The malarial cachexia is stated by Lombard to take the first place in the list of fatal diseases in Vera Cruz. Anasarca is extremely common, and is, doubtless, in many, if not in most, cases a symptom of chronic malarial poisoning. The intermittent and remittent types of fever are frequent, and pernicious fevers, especially of the algid form, are common.

A form of fever, the precise nature of which is doubtful, is, next to malarious diseases, the most fatal complaint. Lombard says that it does not present cutaneous eruptions, fuliginosities of the tongue or lips, meteorism, hæmorrhages, or intestinal ulcerations, but it is marked by great nervous prostration, having a shorter course than ordinary typhoid.

Tuxpan, on the coast, to the north of Vera Cruz, is situated on the left bank of the river of the same name. The population is only about 2500. The place is in a high degree marshy, and intermittent fevers are said to be very prevalent here in September and October. The coast-line generally, from Tuxpan to Tampico, and from the latter to Matamoros on the Mexican side of the Rio Grande del Norte, is all more or less marshy, and infested with intermittent and remittent fevers. Bilious forms of remittent and algid fevers prevail all along this coast.

To the south, again, of Vera Cruz is the small town of Alvarado, which is devastated by intermittents. The province of Tabasco is described by Jourdanet[2] as little better than an extensive marsh, from the interlacing and overflow of rivers. In this region intermittent fevers of the worst kind abound to such a degree that even the Indians have to abandon the empested localities. The town of Carmen, built on a lagoon of great extent, suffers both from intermittent and yellow fevers. The province of Yucatan, which has a dry calcareous soil, covered in some places by a scanty vegetation, in many localities bare and rocky, for the most part arid and destitute of rivers, is only slightly affected with malaria.

Some of the inland places in the warmer zone, such as Chiquihuite, at an altitude of nearly 1000 feet, are notably unhealthy.

If we now turn to the *tierras calientes* of the west coast, we find them generally to be highly malarious. If less unhealthy, upon the whole, than those of the east coast, this is rather owing to the absence of yellow fever than to the freedom of the west from malaria. Jourdanet states that Acapulco, Manzanillo, and San Blas are so malarious as to be scarcely habitable even by the natives. The inhabitants have to leave San Blas and take refuge at Tépic, a town about 3000 feet above the sea-level, for a part of the year. Xalisco, situated only about a mile from San Blas, is more salubrious.

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[1] "Under the torrid zone, the smallest marshes are the most dangerous, being surrounded, as at Vera Cruz and Carthagena, with an arid and sandy soil, which raises the temperature of the ambient air" (Humboldt, *Polit. Essay on Kingdom of New Spain*, vol. iv. p. 199).

[2] Jourdanet, *Le Mexique et l'Amérique Tropicale*, Paris 1864.

Mazatlan is situated at the mouth of the river of the same name, in lat. 23° 10′ N., long. 106° 21′ W. To the north of the town are vast lagoons parallel with the coast. The dry season is from January to June, the rainy season from July to December. The mean temperature is about 30°·0 C. May and June, which are the healthiest months, have a mean temperature of about 35°·5 to 37°·8. The extreme heat and drought, acting on neighbouring marshes, do not, however, prevent these months from presenting a high degree of salubrity. It is the rainy season that is here the most unhealthy, and the season of malarial fevers, simple and pernicious. Mazatlan is, however, much less severely affected with malaria than the towns to the south which we have named.

Guaymas, in lat. 28°, is built on a dry soil, and is regarded as one of the healthiest towns on the coast. It is not, however, quite free from fever. Lombard mentions that 67 cases of malarial fever occurred among the men of *Le Victoire* during a three months' stay at this port. Most of the cases were of the quotidian type. Five of the patients died from pernicious attacks.

Yellow Fever has been frequently epidemic at Vera Cruz, Alvarado, Tlacotalpam, Laguna, and Campéche, in all of which Heinemann[1] thinks it has become naturalised after repeated importations from Cuba. It was, in the same way, thought to be endemic in New Orleans, but a strict enforcement of quarantine has proved the contrary; and this leads us to doubt whether it ever appears on the Gulf coast of Mexico except when imported. That it finds conditions in Vera Cruz specially favourable to its persistence, is shown by the fact that it has appeared there for several years in succession, as, for example, in 1862–65, and it has survived the winter. Yellow fever has also appeared more or less frequently at Tuxpan, Tampico, Papantla, and Matamoros, on the Atlantic coast. On the Pacific coast it has only been observed once, viz. at Manzanillo in 1868. Yellow fever is most prevalent from March to October. The disease attains its maximum in June and its minimum in January.

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[1] Virchow's *Archiv*, 1879 (Hirsch).

Dysentery is not of frequent occurrence in Vera Cruz, notwithstanding the prevalence of malaria; but it is not absent from any part of the Gulf coast. Jourdanet records a terrible outbreak of dysentery which occurred at Campéche in 1848, carrying off 4000 out of a population of 20,000. On the Pacific coast dysentery is widely endemic. It is signalised as prevalent at Acapulco, Mazatlan, and Guayamas, at the last of which the men of *Le Victoire* suffered severely both from dysentery and diarrhœa.

Scarlet Fever is stated by Heinemann to be exceedingly rare in Vera Cruz. This probably holds for both coasts.

Phthisis is prevalent both on the Atlantic and Pacific coasts. Jourdanet notices its frequency at Vera Cruz, Campéche, and Mérida, and Lucas observed it to be common at Guaymas and Mazatlan. *Pneumonia*, on the other hand, is rare, and is chiefly confined to the coloured races.

Hepatitis is rather common on the west coast. Hepatic abscess is not, however, of frequent occurrence in Vera Cruz, where Heinemann "saw only seven cases during a number of years, two of these being in strangers" (Hirsch).

Rheumatic Fever is extremely rare in Vera Cruz.

Chlorosis is very common, especially among young females.

Diabetes is stated to be frequently met with.

Leprosy is widely diffused among the Indians along the coasts and inland.

In the TEMPERATE ZONE malarial diseases are less frequent and severe than along the coast. At the higher elevations they are generally of the intermittent type.

Yellow Fever has appeared at Cordova, and at elevations under 3000 feet, while places above 3500 feet in height, such as Orizaba, Xalappa, and Puebla, have hitherto escaped (Hirsch).

Dysentery and *Diarrhœa* are extremely prevalent on the eastern slopes of the Cordilleras; less so, except at certain points, on the western slopes.

COLD ZONE.

Malaria.—The proportion of deaths from intermittent fever to the total deaths in the city of Mexico is 3·3 per 1000.

The seasonal distribution of deaths, according to Lombard, is as follows:—

It must be observed that winter begins in December.

Spring.	Summer.	Autumn.	Winter.
13	20	37	24

Here, again, as in the States, autumn is the fever season.

Intermittent fever is more prevalent in the villages than in the capital. Coindet thinks that this is partly owing to the soil being more marshy in the neighbourhood of these villages; but, above all, he refers the great prevalence of the disease to the fact that the houses are surrounded by trees, which prevent nocturnal radiation (Coindet, *Le Mexique au point du vue médico-chirurgical*, Paris 1867).

Typho-malarial Fever, or a form of typhoid fever in which marked intermissions occur, is not unknown on the plateau. The pathological lesions are those of genuine typhoid. Classical typhoid is rare.

Typhus Fever is endemic in the cold region, and at times becomes epidemic. The disease known by the natives as "Matlazahuatl," which prevailed at various times from 1545 to 1577, and, later, in 1736 and 1762, has been thought to have been typhus complicated with hæmorrhages; its nature is uncertain.

Yellow Fever never becomes epidemic in the cold regions.

Dysentery is rather common on the plateau in summer and autumn. *Diarrhœa* and *Cholera Infantum* are of frequent occurrence, and give rise to a considerable mortality during the summer months.

Smallpox.—In the villages, where vaccination is much neglected, smallpox prevails to a considerable extent among the general population; but it is among the Indians that the disease is most widely diffused and virulent. According to Coindet, more than one-fourth of the Indians bear marks of smallpox. The maximum of deaths occurs in May and June.

Measles and *Scarlet Fever* are met with, but the latter is not of frequent occurrence.

Phthisis is rare at the higher altitudes; and Jourdanet states that, when acquired at lower elevations, it improves when the patient is removed to districts having an elevation of 2200 mètres. Phthisis is seldom seen among the Europeans residing on the table-land.

Pneumonia is both frequent and fatal on the plateau; adynamic symptoms often appearing during its course, and leading to a fatal issue. Jourdanet ascribes its frequency to sudden chills.

Pleurisy is frequently met with on the Mexican table-land.

Cancer, which is rarely seen in the coast districts, is far from rare in the interior.

Leprosy is generally diffused in all the zones, but it is almost entirely confined to the Indian population.

Scrofula is seldom seen at Mexico, and is still more rarely met with at Puebla.

Goitre is endemic in the territory of Colima, on the western slope of the Cordillera, and in the mountainous districts of Tabasco and Chiappas (Hirsch).

The *Mal de los pintos,* or pinta disease, a mycotic skin affection, characterised by spots of various colours, forms, and sizes on different parts of the body, and emitting a bad smell, is endemic on the west coast. It is also met with in Central America, Venezuela, New Grenada, Chili, and Peru.

Syphilis is widely diffused, both amongst the Indian and Spanish populations. The French troops suffered to a great extent from this malady during their occupation of the country, and it often assumed grave forms, rebellious to treatment. The Indians who have no intercourse with Europeans seem to be entirely free from syphilis at the present day, just as under the same conditions they have escaped the disease in the United States. This is scarcely to be reconciled with the opinion that it was endemic among the Aztecs when the Spaniards arrived in Mexico, and that they communicated the disease to their conquerors. It certainly appears more probable that syphilis was introduced into Mexico by the Spaniards, just as it is being propagated by their descendants among the Indians at the present day.

Rheumatic Fever is observed to be of frequent occurrence on the Anahuac plateau.

CHAPTER V.

CENTRAL AMERICA.

Central America comprises the States of Guatemala, Belize or British Honduras, Honduras proper, San Salvador, Nicaragua, Costa Rica, and Panama. This belt, extending for about 1000 miles from Guatemala to Panama, is the connecting link between North and South America. The Cordillera range, which may be regarded as the central part of the mountain system which under the name of the Rocky Mountains traverses the Northern Continent, and under that of the Andes skirts the western side of South America from Colombia to Cape Horn, forms the chief feature of Central America. At the isthmus of Panama this range in some places has a very slight elevation, being only 260 feet high; but it increases in elevation as we follow it to the north, attaining heights of from 4000 to 9000 feet. Even at Panama the peak of Picacho, in the Department of Chiriqui, rises to 7200 feet.

The Cordilleras, as a range, follow the line of the Pacific coast of Central America, throwing out ramifications towards the Atlantic coast in Honduras, Guatemala, and Nicaragua. In Nicaragua the Cordilleras may indeed be said to form two parallel chains, between which are placed the Nicaragua and Managua lakes. It follows from this that on the Atlantic side the plains are more extensive, level, and less elevated. The rivers (although none of them of great importance) are longer and more sinuous in their course. In Panama alone no fewer than 149 streams fall into the Atlantic, and 326 into the Pacific. From the fact that the rainfall is heavy and the drainage slow, it can readily be understood that the country on the Atlantic coast, which is in many parts covered with impenetrable forests, is to a large extent swampy.

On the western or Pacific coast the belt between the sea and the mountains is narrow. The land rises in successive terraces towards the summit of the range, forming hot, temperate, and cold zones, such as we have described in Mexico.

The mean temperature on the Atlantic coast varies in different districts from 77° to 85° F. It is, as a rule, a few degrees higher along the coast belt on the west. As we ascend from the west coast line towards the higher lands, we pass through a succession of climates. At San José, in Costa Rica, at an elevation of 4500 feet, the mean annual temperature is 68° F. At higher elevations it is much lower. The rainy season extends from April or May to November. There is this difference, however, to be noticed between the two coasts, that whereas on the Pacific coast there is a well-marked dry season, lasting from the middle of November to the middle of May,—during which it seldom rains,—the rains do not cease on the Atlantic coast during these months. In the rainy season, along the Atlantic shore, the rains are often torrential,—or storm-rains,—and during what is the dry season on the Pacific the rains along the Atlantic are more moderate, but continue to fall more or less every month.

BRITISH HONDURAS.

Commencing with the Atlantic coast, we shall first notice the British Settlement of Honduras, which may be taken as exhibiting many of the characters, physical and climatological, of this region. Gibbs[1] states that for a few miles inland from the coast, the country is low and swampy, abounding in rich vegetation. The swamps and lagoons are thickly grown with mangrove. As we ascend the river, we find ourselves, he says, shut in by lofty banks. Towards the western, and particularly towards the south-western boundary, the country rises into table-lands. The highest point is the Cockscomb Mountain, having an elevation of 4000 feet.

The following is given by Gibbs as the monthly mean temperature F. for 1878, and the average rainfall, cm., according to Hann:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	85°	79°	83°	87°	86°	87°	86°	86°	84°	74°	78°	76°
Rainfall, . . .	7·0	4·0	1·4	1·6	1·6	6·5	8·1	7·4	6·9	16·1	7·1	8·5=76·2

The principal features of the climate appear to be the comparative absence of rain for three or four months from the end of February; and an equable temperature, with strong easterly winds, in the dry season. In winter, cold northerly winds, dry and bracing; average rainfall, 40–50 inches; average temperature, from 74° to 87° F., and ranging from 56° to 96° F.

Malaria.—We learn from an account of British Honduras by Hamilton,[2] that the fever season here is during August, September, and October, although cases are met with at all seasons. As a rule, he says, all Europeans are attacked. During the autumn of 1862, this writer was not aware of a single white man in the place that escaped without some form of malarious attack. The admissions among the black troops rose to 200 or 300 per cent., nearly all the cases being fever of an intermittent type. "What will one day present the characters of a tertian, will in a few days assume those of a quotidian; then, perhaps, will suddenly become remittent, and often almost continued in its type. The cold stage is sometimes absent; sometimes the sweating stage does not appear, and, as a consequence, great enlargement of the spleen follows."

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[1] *British Honduras*, Lond. 1883.

[2] *Dublin Quart. Journal of Med. Scien.* 1867.

It must, however, be remarked that the year 1867, to which he refers, was an unusually unhealthy one. The annual rates of admissions of black troops, from 1859 to 1866, from miasmatic diseases, was 423·0 per 1000, and the deaths 2·43. Gibbs gives the death-rate of Belize (town) at 33 per 1000, which indicates a more favourable view of the climate than that which generally prevails.

Yellow Fever seldom visits the Colony. A few cases occurred among the white population in 1860, and again in 1869, but it is not endemic in Belize.

Enteric Fever is said by Hunter[1] to be absent from the Colony; this at least proves that it is rare.

Typhus is unknown.

Smallpox is seldom seen. The only time within the memory of the oldest inhabitant when it broke out was in the year 1856.

Scarlet Fever is rare, but of a malignant type.

Asiatic Cholera visited the Colony in 1836, and again in 1854, and on the latter occasion it was severe. It once more made its appearance in 1867–68, when it was introduced from New Orleans.[2]

Dysentery and *Diarrhœa* are moderately common; the former being sporadic in character.

Phthisis appears to be excessively fatal among the black troops stationed in Honduras, the ratio of deaths from tubercular disease (1859–66) having been 4·04 per 1000 of strength; but as Hunter seems to think that this disease does not originate in the Colony, we conclude that it is rare among the permanent population.

Pneumonia occurs among the old and weak during the cold winter months.

Scrofula and *Rickets* are rare.

Liver Diseases are frequent, but of no great gravity.

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[1] Bristowe and Wright, *British Honduras*, Edin. 1889.

[2] *Army Medical Report*, 1868.

GUATEMALA.

The Atlantic coast of Guatemala is of small extent; but, being indented with deep gulfs, and traversed by the Mortagua River, it is swampy and unhealthy. Fever, dysentery, and hepatic diseases, including tropical abscess of the liver, are the prevailing maladies on the east coast.

Nueva Guatemala, the capital, situated at an altitude of 4961 feet, enjoys a cooler climate, a good water supply, and is situated on a fertile table-land. The following table gives the average rainfall of this station. The average monthly temperature is taken from Lombard:—

	Guatemala.	
	Average Rainfall.	Mean Temperature.
	mm.	°
January,	7·0	18·88
February,	3·0	18·78
March,	21·0	20·54
April,	75·0	21·75
May,	142·0	21·35
June,	281·0	21·73
July,	274·0	20·73
August,	226·0	20·63
September,	227·0	20·81
October,	183·0	16·66
November,	12·0	19·55
December,	9·0	19·00
Total,	1460·5	20·03

The Consul-General, Hayes Sadler, in a late report on this Republic, remarks that during the dry season, from the end of October to April, everything is burnt up with drought, but he considers the climate of the interior as healthy.

Malarial Diseases are comparatively rare in the capital. To what extent *Typhoid Fever* prevails is uncertain. *Typhus* is unknown. *Croup* is rare, and I have met with no mention of diphtheria. In 1890 a severe epidemy of *smallpox* carried off 20,000 victims in the cities of this Republic.

As we descend to the Pacific coast, endemic diseases resume the chief place in the pathology of the country—the banks of the rivers being specially malarious. The west coast line throughout its extent is hot and feverish. The port of Istapa is notably malarious.

Goitre is endemic to a large extent in the *tierras templadas*.
Syphilis is widely spread among the whites and half-castes.
Rheumatic Fever is seldom seen.

HONDURAS, SAN SALVADOR, AND NICARAGUA.

The Republic of HONDURAS extends from the Caribbean Sea to the Pacific Ocean, between Guatemala on the north-west and Nicaragua on the south-east. The country is mountainous in the interior, and well watered, with many lagoons along the shore. I have come across no accounts of the diseases peculiar to the country.

The small State of SAN SALVADOR lies between Honduras and the Pacific. Two parallel chains of mountains form an interior valley of great fertility, lying at a considerable altitude, and enclosing numerous lakes, the most important of which is Lake Guija, having a circumference of 90 miles. The climate of the open and elevated table-lands is salubrious. The valleys of the Rio Lempa and Rio San Miguel are malarious, as is also, in most places, the alluvial strip lying along the coast. The town of Acajutla is stated to be subject to malarious fevers of some intensity.

Yellow Fever has only once visited this region, viz. in 1868.

Phthisis is a rare disease on the elevated regions.

Hepatitis is stated by Lombard to be frequent, not only on the low lands, but also at altitudes up to 1000 mètres, as is the case in the village of Castagnatique, in the province of San Miguel.

Dysentery appears to be endemic, not only in the low lands, but also at considerable elevations; *Diarrhœa* is also of frequent occurrence.

NICARAGUA is traversed by two ranges of mountains, enclosing a great interior basin, at no great elevation, in which lie the lakes Nicaragua and Managua. On the east the country opens out into extensive and densely-wooded plains, traversed by rivers of some magnitude.

Malaria.—Little is known of the country, except what is comprised in the general statement that both coasts are malarious. The town of St. Juan de Nicaragua, or Grey Town, on the south-east coast, being a resort of Europeans, is the point with which we are best acquainted. Its surroundings are marshy. The inhabitants suffer considerably from fever, and the malarial cachexia, with enlargement of the spleen, is not unknown; yet the European residents are said to enjoy fair health.[1]

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[1] Pim and Seeman, *Panama, Nicaragua, and Mosquito*, Lond. 1869, p. 239.

Yellow Fever has only once been observed—in 1868. *Typhoid Fever* has not, so far as I know, been recognised. *Typhus Fever* in an epidemic form was observed by Bernhardt in 1851. Nicaragua was visited by *Cholera* in 1837, 1856–1866.

Dysentery is to be classed among the severe endemic diseases of the country.

Pneumonia is comparatively a rare disease in Nicaragua, but *Phthisis* is somewhat frequent along the coasts.

Syphilis is widely diffused, except among the Indians in the interior who have not contracted the disease from the white settlers.

Goitre is met with in the mountainous districts.

COSTA RICA.

Costa Rica lies between Nicaragua and Panama, stretching from the Atlantic to the Pacific. The interior is mountainous. The capital, San José, has an altitude of 4500 feet. The population, which is mostly concentrated on the central plateau, is estimated at 196,270, including 10,000 uncivilised Indians.

Malaria.—The sea-coasts suffer, as do the other parts of Central America, from malarial fever. Punta Arenas, on the Gulf of Nicoya, is specially liable to fevers, generally of the quotidian type. A railway has recently been constructed, which, according to Bowallius, has cost thousands of lives.[1] The higher elevations of the interior are salubrious.

Typhoid Fever is rare on the coasts, but is more frequent on the table-lands. *Yellow Fever* has seldom visited the Atlantic shores of the Republic, and it is doubtful if it has ever occurred on the Pacific coast.

Smallpox has at various periods committed great ravages among the Indian tribes; but the disease is seldom seen at the present time among the white population.

Scarlet Fever was observed by Schwalbe in 1856, but it is not endemic in the country.

Measles are not of frequent occurrence.

Whooping-Cough was epidemic here in 1866, but it does not appear to be of such frequent occurrence as in the West Indies.

Asiatic Cholera visited Costa Rica in 1856 for the first and last time.

Dysentery is, next to malaria, the most common disease on the coasts and low plains; it is less frequent on the central plateau.

Pneumonia is comparatively rare in Costa Rica, and the same may be said of *Phthisis;* and this holds true to some extent of the coasts, but more particularly of the highlands of the interior.

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[1] *Proceedings Royal Geo. Soc.* 1884.

Bronchitis is common on the table-land.

Leprosy is met with in some of the mountain valleys, but not to any great extent.

Goitre is also endemic in some of the hill districts.

PANAMA.

Panama forms one of the States of Colombia, occupying the south-eastern extremity of Central America, and may be said to stretch east to the Gulf of Darien and the river Atrato.

The climate of this State is hot and humid, maintaining what Nicolas calls "un marais aérien permanent." The following table, which has been kindly supplied by the officials of the Panama Canal, gives the mean temperature and rainfall for Colon on the Atlantic, of Gamboa situated midway between the two oceans, and of Naos on the Pacific. The monthly number of admissions and deaths in the company's hospitals for fever and dysentery are also given:—

Months.	Fever.		Dysentery.		Mean Monthly Temperature. Mean of Maximum and Minimum Means.			Rainfall in Millimetres.					
	Admissions.	Deaths.	Admissions.	Deaths.	Colon.	Gamboa.	Naos.	Colon.	No of Days.	Gamboa.	No. of Days.	Naos.	No. of Days.
January, . .	319	7	7	3	27°·0	26°·8	26°·2	15·6	8	3·0	2	1·8	4
February, . .	227	9	4	1	26·3	26·7	26·0	39·8	9	21·5	4	...	...
March, . . .	147	8	12	3	27·2	27·7	26·5	32·0	13	10·0	4	0·8	2
April, ...	161	5	10	2	26·9	27·5	27·2	58·9	12	32·5	9	7·0	3
May, ...	160	3	4	1	27·9	28·1	27·8	293·9	23	520·0	21	141·2	15
June, ...	196	13	13	8	27·4	28·1	27·2	244·4	18	303·5	16	124·3	11
July, ...	294	7	7	2	28·1	28·0	27·8	296·4	17	83·0	11	50·8	8
August, . . .	344	11	6	3	27·5	27·5	26·8	249·0	23	284·5	16	145·0	16
September, . .	296	6	8	2	27·3	27·2	26·5	411·4	23	312·5	19	217·6	21
October, . . .	317	13	12	4	27·1	27·7	26·7	506·9	21	243·0	18	206·0	21
November, . .	306	20	5	4	27·2	27·8	26·5	609·2	22	311 0	16	102·3	13
December, . .	209	10	9	1	26·9	26·6	25·8	339·0	22	322·5	22	141·8	17
Totals, . .	2976	112	97	34	326·8	329·7	321·0	3096·5	211	2447·0	158	1138·6	131
Monthly Means	248	9·333	8·083	2·833	27·23	27·47	26·75	258·04	ds. hs. 17 14	203·91	ds. hs. 13 4	94·88	ds. hs. 10 22

Malaria.—The extreme unhealthiness of these shores is no matter of recent experience, although it has been abundantly confirmed during the construction of the railway and the works on the canal.

In November 1689, a Scotch colony, numbering 1200, landed at Darien. For some time, as it was the dry season, the settlers remained moderately healthy. Before the equinox, as Macaulay informs us, disease began to make fearful havoc in the little community. The mortality rose to ten or twelve a day. Those who were not on their beds were yellow, lean, and feeble, hardly able to move the sick or bury the dead. The remaining settlers betook themselves to their ships and made for the United States; but more than half of those that embarked perished during the voyage, and those that survived were miserable skeletons. A second party of 1300, landing after the pioneers had left, experienced, if possible, worse sufferings. Attacked at once by the climate and the Spaniards, in little more than three months, and these the healthiest months of the year, 300 men had been swept away by disease. Those who survived were so thoroughly prostrated by disease, that their enemies had even to assist them to raise the anchor when preparing to leave, and only about thirty, it is said, of this second party were fortunate enough to reach their native land.

The digging of the canal has been attended by a high mortality, especially at the beginning of the undertaking. Of a force of 7000 men, the company reckoned that about 1000 men were always in hospital. The sickness and death rate among the labourers, Bowallius says, were very high. Latterly, we are told, they found a race of men that resisted the climate better. This was a tribe of Indians from the Magdalena River.[1] There was not a single French engineer who had been able to attend to the work beyond one year and a half, although the contract was for two. In Panama and its vicinity, thirty-seven engineers out of less than a hundred died during the months of March and April 1882.

The table given above does not enable us to estimate accurately the proportion either of admissions or of deaths. The maximum number of labourers and employés in 1888 is given at 15,000; but the minimum is uncertain, as well as the average per month. It is probable that many of the sick left the works to escape death. This was at least the case with the labourers from Jamaica. We observe from the table that fever is at its minimum in March, April, and May, but prevails throughout the other nine months of the year, especially from August to December. In other respects the pathology of Panama differs little from that of Costa Rica, except that pneumonia is stated to be of more frequent occurrence in Panama.

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[1] Dr. Bowallius, *Pro. R. G. Soc.*, January 1884.

AMERICA.

DIVISION II.

WEST INDIA ISLANDS AND SOUTH AMERICA.

CHAPTER I.

WEST INDIA ISLANDS.—THE BERMUDAS AND BAHAMAS.

GEOGRAPHY AND CLIMATE.—The Bermudas, or Somers' Islands consisting of above 300 islets and rocks clustered together in a small area, and measuring in all about 12,000 acres, are situated about 500 miles to the east of Cape Hatteras in North Carolina. They are of coral formation. About one-third of the soil is fertile and under cultivation; the rest consists of stony ground, or brackish marshes overgrown with coarse grass, rushes, or mangrove jungle. The population is 16,096. The mean temperature of the year is 74° F. The hottest month (July), 83° 5′ F.; the coldest (February), 64° 5′ F.; the yearly fluctuation is 19° F.

PATHOLOGY.—*Malaria.*—Paroxysmal fevers are not endemic in the group. The few cases that occur among the troops are probably always contracted elsewhere. Thus, in 1880 there were eight cases of ague in a strength of 1974; but it is stated that in every instance the patients had contracted the disease previous to their arrival in the island. Don mentions the existence here of a simple continued fever without any malarial complication.[1] Parkes states that in 1860 a continued fever was prevalent, which gave rise to 209 admissions in a force of 1052 men, but was of a mild type, and caused only a small mortality. It prevailed in September, October, and November. He is doubtful as to its nature. The small mortality seems to exclude typhoid fever.

Typhoid Fever is met with in an epidemic form in the Bermudas, and, according to Don, it can seldom be traced to any specific cause, and in a large proportion of cases the symptoms are not pathognomonic. The rash is often wanting, and the stools are nearly always green, dark, or bilious.[2] The same difficulty of tracing the disease to any definite cause is noted by Ogilvy.[3] In 1888 a severe outbreak of typhoid fever occurred among the troops. The ratio of admissions was 95·1 per 1000, and the ratio of mortality

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[1] *Trans. Epidem. Soc.* vol. iv. 1879–80.

[2] Fayrer's *Climate and Diseases of India,* London 1882.

[3] *Army Medical Report,* 1881.

13·37. Pulmonary complications were very prevalent; epistaxis was frequent; severe relapses were frequent. As sequelæ thrombosis of the veins of the leg was observed in two cases, and sub-acute periostitis of the femur in one case. As the town of St. George is said to be quite unsewered, badly built, and badly supplied with water, the risk of infection from a specific cause should not be overlooked, the more so, as there is reason for believing that the disease is endemic among the civil population.

Yellow Fever has often been epidemic in Bermuda, being always imported from without. Hirsch has recorded ten epidemies between the years 1699 and 1864.[1] A limited epidemy (four cases in all, with three deaths) of this disease, or one so similar as to be mistaken for it, occurred in 1867, "which, not being traceable to importation, was supposed to have been caused by exhalations from the military cemetery." The cases were confined to men belonging to the Royal Artillery.[2]

Typhus Fever is not endemic in these islands; a few cases have been noticed at rare intervals among the soldiers.[3]

Dengue occurs sporadically in the Bermudas, assuming an epidemic form from time to time.

Asiatic Cholera has never visited these islands.

Dysentery, Diarrhœa, and *Sporadic Cholera* are by no means rare, but the first of these is generally of a mild type.

Respiratory Affections are comparatively rare. The average admission-rate among the troops is 30·0 per 1000, or about a half of that observed in the United Kingdom.

Phthisis is only moderately prevalent; but advanced cases of the disease do not do well in the Bermudas, being observed to run a rapid course to a fatal termination.

Rheumatism, in its widest sense, is less common than in England. *Rheumatic Fever* is also met with, but to what extent it prevails is uncertain.

Syphilis and venereal affections generally are remarkably rare, and of a mild type.

THE BAHAMAS.

GEOGRAPHY AND CLIMATE.—The Bahama Islands form a chain stretching from opposite the coast of Florida for about 600 miles to the south-east, terminating to the north of Haiti. They number in all about 3000, of which only 20 are inhabited. The population is 43,521.

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[1] For an account of the various epidemics to which Bermuda has been subject, see *Trans. Epidem. Soc.* 1867.

[2] *Army Medical Report,* 1887.

[3] An epidemy in the jails in 1779–80, at that time crowded with prisoners of war, counted by Hirsch as yellow fever, was more probably one of typhus.

The mean temperature of the year at Nassau is 79° F. The absolute minimum being about 56° F., the maximum 96° F. July is the warmest month, and February or March the coldest. The annual rainfall is from 45 to 50 inches, the wettest months being from May to October. There is no real dry season.

Malaria.—The average admissions and deaths per 1000, for fevers, dysentery, and diarrhœa, for the three years 1865–67, were as follows:—

	Admission-rate.	Death-rate.
Intermittent Fever, . . .	32·8	0·00
Remittent Fever, . . .	74·3	1·20
Continued Fever, . . .	31·1	0·85
Dysentery, ...	4·3	0·00
Diarrhœa, ...	16·6	0·00

The mean total fever admission-rate for three years was 138·2, and the death-rate 2·05 per 1000, which does not indicate any high degree of prevalence or intensity of the malarious element.

Cholera has only once visited these islands, viz. in the year 1852.

Dysentery and *Diarrhœa* are neither common nor fatal.

Typhoid Fever is met with, but is not prevalent.

Yellow Fever has been introduced into the Bahamas on four occasions only, viz. in 1861, 1862, 1863, and 1869.

Phthisis is a fatal disease among the black troops stationed in the Bahamas, causing, for the eight years 1859–66, an average death-rate of 11·04 per 1000.

The equability and mildness of the climate has made the Bahamas a favourite resort of patients suffering from consumption and other pulmonary complaints. I judge from this that pneumonia and bronchitis are by no means frequent among the white population and temporary residents; but the black troops stationed at Nassau do not show a favourable record as regards these diseases. The death-rate during the four years 1864–67 was 3·5 per 1000 from pneumonia, and 1·9 per 1000 from bronchitis.

Hepatitis is not of frequent occurrence in these islands.

Leprosy is met with, but to what extent I have not ascertained.

CHAPTER II.

CUBA.

GEOGRAPHY AND CLIMATE.—Cuba is the largest of the West India Islands, being about 750 miles in length, and, on an average, 50 miles broad. It is situated between 19° 50′ and 23° 9′ N. lat., and 74° 8′ and 84° 58′ W. long. The population is 1,400,000, of whom about one-half are coloured. The interior is mountainous, especially at the south-east, where the Sierra Maestra rises to a height of 8000 feet. Along the north and south coasts are extensive and fertile plains devoted to the culture of sugar, rice, and tobacco. Much marshy ground exists in the plains, and muddy shallows surround a great part of the coast. The rivers are short — running to the north and south from the central range.

The average annual temperature of Havana, the capital, is 25°·3 C.; that of January is 22°·20, and that of August 28°. There is thus great uniformity of temperature throughout the year.

The average rainfall in mm. is as follows:—

January,	83	July,	124
February,	42	August,	122
March,	39	September,	152
April,	81	October,	172
May,	104	November,	56
June,	144	December,	56

PATHOLOGY.—*Malaria.*—Malarious fevers prevail both on the coasts and along the course of the rivers (Drake). The province of Matanzas, on the north coast, to the east of Havana, is specially noted as malarious. In addition to the intermittent and simple remittent forms, bilious remittent is very common.

Sullivan, who writes from personal knowledge, remarks the prevalence of bilious and hæmorrhagic symptoms in the remittent and intermittent fevers of Cuba. He defines the bilious fever of Cuba as "a pyrexia, which, under any and every type, always exhibits an essential, and often the only symptom of the bilious condition—

jaundice, vomiting, the characteristic stools and urine of a bilious attack; and when the symptoms become aggravated, there are cerebral and hæmorrhagic symptoms which may be attributed to an alteration of the blood through the bile. Jaundice," he says, "may make its appearance from the outset, and diminish and increase with the exacerbations of the fever. Vomiting is one of the earliest symptoms. The vomit is yellow, bright green, and afterwards assumes a darker hue. The urine is of the colour of ink or strong coffee. This is not owing to the existence of bile alone, but also to the large proportion of the constituents of blood in the urine. By the microscope we may detect the red globules of an irregular shape. The presence of blood in the urine may be intermittent, like the fever. As the fever returns, so does blood in the urine." As proving the malarious character of this fever, he points out that it is attended with enlargement of the spleen. This fever may become complicated with ataxic, algid, or comatose symptoms, and tends to develop the malarious cachexia. He states that the new-comer is seldom attacked; that the disease is chiefly seen in the Creoles or the acclimatised, and in patients slightly cachectic, who have already suffered from frequent attacks of intermittent fever (*Medical Times and Gazette*, July 1, 1876).

Typhoid Fever was epidemic in Cuba in 1853–54. It is probably endemic in the island.

Yellow Fever is endemic along the coast of Cuba, breaking out from time to time in an epidemic form, but is never observed to extend to the mountainous regions of the interior. As an epidemic, the disease is most prevalent during the warm season, but cases occur throughout the year. In non-epidemic years it is in summer that sporadic cases are most frequently seen.

In Cuba and other of the West India Islands, in which yellow fever is endemic, as well as in Sierra Leone, one is struck with the prevalence of a so-called bilious fever, with jaundice and vomiting, the vomit in many cases approaching more or less to the characters observed in yellow fever. Malarial fever, as we have seen, also frequently assumes in all of these localities a bilious hæmorrhagic character, that renders diagnosis difficult. But it should be remarked that cases of remittent fever with jaundice and coffee-ground vomiting are not restricted to marshy localities in those countries where yellow fever is endemic, but are met with in non-marshy localities, such as St. Pierre, in Martinique, where malaria is not prevalent. It is, at least, an open question whether these are or not, in many instances, cases of mild yellow fever.

The comparative immunity from the disease which the natives of countries where yellow fever is endemic enjoys, may be owing to their having already had the disease in the milder forms, which are spoken of as bilious remittent.

As we are now dealing with a country which is considered to be the chief endemic habitat of yellow fever, it may not be out of place here to make a few remarks upon the general distribution and characters of the disease.

Until comparatively recent times, yellow fever, as an endemic disease, was restricted to two regions—the West Indies (including the Gulf coast of America), and a part of the coast of Senegambia, extending from the Gambia River to the southern limits of Sierra Leone; but more particularly limited to the latter colony. The disease was introduced into Brazil in 1849, and from that time it has never been entirely absent from the country, so that Brazil must now be counted as a third endemic seat of the yellow fever. Outside the limits which we have thus roughly indicated, yellow fever has never appeared except as an imported malady, and in an epidemic form, which, after a longer or shorter period, has completely died out.

Why the disease should be endemic in Sierra Leone, and not in Senegal, on the Gold Coast, or at Lagos; or why it should be endemic in Cuba and not in Belize, are questions that cannot, with our present knowledge, be answered. It does not seem to be a question of race; and if its endemicity is determined by soil or climate, we are at a loss to know to what peculiarities of either it is to be ascribed.

Although history casts an uncertain light upon the subject, it may be safely assumed that the original habitat of yellow fever was the West Indies, from which it was, in all probability, introduced into, and naturalised in, Sierra Leone in the seventeenth century, when the intercourse between the two countries, arising from the slave trade, was so frequent.

But while it is clear that the disease is indigenous to the West Indies, it is by no means easy to define the precise localities within which it is truly endemic. It was formerly believed to be indigenous all along the Gulf coasts of Louisiana and Mexico, but the complete disappearance of the disease from the Southern States, which formerly suffered so severely from it, as a result of strict quarantine regulations, proves conclusively that it is not endemic in this region. The same may be, and probably is, the case as regards the whole Gulf coast of Mexico, Central America, and the shores of the Caribbean Sea. It is certainly never seen in British Honduras or Nicaragua, except as an imported disease. The original and present habitat of the disease is therefore to be looked for in the West India Islands; and we must still further restrict its endemic limits by excluding Trinidad, the Bahamas, and probably Barbadoes and Jamaica. Yellow fever appears to be truly endemic only in that island girdle stretching between 61° and 85° W., including Cuba, Haiti, Porto Rico, Santa Cruz, St. Thomas, and the smaller islands west to Martinique. It need not be held that it is endemic in all the islands within these limits. Haiti and Cuba are to be regarded as the principal and perennial sources of infection. Temporary centres of infection have been formed on the Gulf coast and elsewhere.

Yellow fever is undoubtedly transportable from place to place by infected ships, cargoes, and persons, and in this manner it has been carried from the endemic centres which we have mentioned to many countries outside the yellow fever zone. From the West Indies it has from time to time been introduced into the principal ports along the Atlantic Ocean as far as Halifax, in lat. 44° 26′ N., and to Monte Video, in lat. 36° S. It has appeared at some points on the Pacific coast of Ecuador and Peru, and also on this side of the Atlantic in the Iberian Peninsula, Majorca, France, and even in England, where it has more than once appeared, both at Swansea and Southampton.

From the secondary centre at Sierra Leone, it has spread in an epidemic form to Senegal, Grand Bassam, the Cape Verde Islands, and the Canaries.

It is generally limited to coast towns, or to towns situated on navigable rivers having commercial communication with primary or secondary centres of infection, and it is usually most fatal in the low and filthy parts of such towns. It is more readily introduced into, and persists longer in tropical, or very warm, than in colder countries, and is everywhere most prevalent during the warmest months of the year. As an epidemy it becomes extinct when the temperature falls below the freezing-point.

Its spread is also, in a marked way, determined by altitude. It seldom reaches to localities situated higher than 1000 feet, although it has reached on one occasion, in Jamaica, an elevation of 4000 feet.

New arrivals in a country where yellow fever prevails in an epidemic form are more liable to be attacked than natives, or than those who have become acclimatised. The white races are more subject to the disease than the negro; and the whites from the colder latitudes are attacked in larger proportions than those belonging to warmer regions. The negro stranger is not immune to the disease in the same degree as those of the same race who have resided for a long time in a yellow-fever habitat; and the natives of countries where the disease is endemic are said to lose their immunity by prolonged residence in a healthy country, or even in a healthy district in the same region. It is even said that the immunity holds good only for the special locality in which it has been acquired, so that a native of one country where the disease is endemic has little or no security from attack when he removes to another; but this statement requires confirmation. One attack of yellow fever is usually protective against a second, although second attacks, generally of a mild character, do occur. The relative immunity of natives of countries where the disease is endemic is probably owing, as we have said, to their having already suffered from a mild attack of the disease.

The character of the soil does not appear to have any influence upon the spread of yellow fever. It is quite as much at home in a dry as in a marshy country. It has been observed that severe epidemies of the disease at New Orleans and some other places have coincided with excavations of canals or other works, by which the earth is extensively disturbed; but if such upturning of the soil has any influence on its spread or intensity, it certainly will not give rise to an epidemy of the disease in a country outside its endemic bounds, unless perhaps the germs introduced during a former outbreak have been latent in the soil.

Yellow fever will thus be seen to be a disease subject to many limitations. It is limited as regards its endemic centres, and in respect to the distance inland to which it extends. It is further limited by altitude, temperature, race, and acclimatisation; but notwithstanding all of these limitations it has justly been classed with plague and cholera among the pestilential diseases, on account of the facility with which it is transported, and the great mortality it occasions.

Cholera.—Cuba was visited by cholera in 1833–35, when it caused frightful ravages, particularly in the towns of Matanzas and Havana, and later along the whole of the south coast. Scarcely less destructive was the second outbreak in 1850 and the following years. The third and last outbreak of this pestilence occurred in 1867, when it continued its ravages for three years (Hirsch).

Dysentery, although not so severe as in some Eastern countries, is to be regarded as endemic in the island. It is signalised as prevalent in Santiago de Cuba.[1]

The eruptive class of fevers, with the exception of smallpox, do not appear to take so prominent a place in the pathology of Cuba as in that of Europe.

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[1] Vincent, *Archiv. de méd. nav.*, February 1889.

Smallpox prevails to a large extent at the present day, causing a great loss of life. In 1887 the deaths in Havana during ten months numbered 1452.

Measles appears to be of rare occurrence; and it is doubtful if *Scarlet Fever* is known; upon this point further information is necessary. The relative prevalence and distribution of respiratory diseases in the various districts of the island is unknown. *Croup* is seldom seen; but *Diphtheria,* which is probably to be understood by the term malignant sore throat, has been several times observed in an epidemic form at Havana.

Cuba is one of the West India Islands in which *Pneumonia* is rather frequent, and it is most fatal amongst the coloured population. *Bronchitis,* according to all authorities, is rare, and, like pneumonia, is most common among the negroes. *Phthisis,* which is also more fatal to the coloured race, is far from rare in Cuba, notwithstanding the prevalence of malaria.

Hepatitis and *Abscess of the Liver* are more common in Cuba than in the West India Islands generally; the low marshy, malarious coast localities, such as Santiago or Cuba, are those most affected.

Leprosy is widely diffused throughout the island, but is chiefly restricted to the coloured population.

CHAPTER III.

JAMAICA.

GEOGRAPHY.—Jamaica extends between 17° 43′ and 18° 32′ N. lat., and between 76° 10′ and 78° 20′ W. long. It is about 150 miles long by 50 miles broad; the population of the island in 1881 was 580,804, of whom the whites numbered only 13,000 to 14,000. In 1888 the mean population was estimated at 613,376. According to Bent, the foundation of the island is limestone; "but this has undergone so many changes from igneous action in some parts, and aqueous in others, that the general aspect of the country in configuration, soil, and climate probably varies more than any given area of similar extent elsewhere. Thus, in one portion, immense upheavals of volcanic action have taken place, and metamorphic rocks have been thrust through the limestone, giving a shattered character to the mountains. Deep glens and ravines are the natural consequence, channelled with streams and rich with vegetation. About a third of the island, chiefly its eastern section, follows this conformation. On this formation is placed the mountain cantonment of Newcastle, and on its northern boundary that of Port Antonio. In other parts the limestone has been washed by percolation into cavities and fissures among the mountain ranges, or has settled down in large plains and savannahs, watered almost entirely by the periodical rains, which, when they fail, leave the land parched and unproductive; and when excessive, or even of average volume, cause a saturation of the soil favourable to vegetation, but also productive of vegetable decomposition and malaria. In tracts of this description are the stations of the Up-Park Camp, Kingston, and Spanish Town."[1]

The island is traversed from east to west by a range called the Blue Mountains, which rises in some places to elevations of 7400 feet. Numerous streams descend from this range to the north and south shores, but none of them are of any great size. The only one that is navigable is Black River, which falls into the sea on the south-west coast. As the rivers pass through the level-coast plains, they form in numerous places marshy tracts in their course or at their mouths.

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[1] *Army Medical Report*, 1865.

CLIMATOLOGY.—The mean temperature at Kingston, the capital, at the sea-level, is 78° F.; that of Newcastle, at an elevation of 4000 feet, is 66° F.

At Up-Park, 235 feet above the sea, the mean temperature and daily range for 1864, and the rainfall (average of four years), were as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Mean Temperature F. (1864), .	83·6	83·0	74·6	77·5	78·1	79·3	81·5	82·7	83·2	81·1	81·2	81·3	=80·6
Daily Range (1864), F., . .	15·3	15·1	14·5	15·5	14·5	15·2	14·5	19·8	15·9	20·3	18·9	20·6	=16·6
Rainfall (average of 4 years), in.	2·54	3·77	2·09	1·56	14·00	3·80	3·83	11·20	6·57	5·15	10·85	3·36	=68·72

The total rainfall, and its distribution, are subject to great variation. Taking the above as an average, the quarterly distribution is as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
8·40	19·36	21·60	19·36

The rainfall at Newcastle is nearly double that of the Up-Park. It will be seen from the subjoined table, which is for 1886, that the annual fall in different divisions of the island varies considerably:—

North-Eastern Division, ...	86·40 inches.
Northern Division, ...	56·47 ,,
West Central Division, ...	74·40 ,,
Southern Division, ...	49·27 ,,

The mean monthly fall for the four divisions, for that year, was as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
4·50	2·35	3·39	3·25	8·45	4·92	4·23	6·75	6·76	9·65	6·69	5·70 =	66·64

PATHOLOGY.—*Malaria.*—The medico-military history of Jamaica in the past has been far from favourable, as may be judged by the figures given by Parkes, which refer to white troops:—

	Admissions per 1000.	Deaths per 1000.	Fever Deaths per 1000.
1817–1836, . .	1812	121·3	101·9
1837–1855, . .	1371	60·8	Not given.

The removal of the troops from the plains to the mountain station of Newcastle was followed by a great diminution, both in the sickness and mortality, especially the latter.

	Admissions per 1000.	Deaths per 1000.	Fever Deaths per 1000.
1859–1864, . .	943·1	12·10	4·63

The influence of altitude in diminishing the prevalence of malarious disease is further illustrated by Parkes, who gives two specific examples:—

	1859.		1863.	
	Newcastle.	Port Royal.	Newcastle.	Up-Park.
Fever Admissions per 1000, .	29·1	443·5	48·0	547·6

At the present day the black troops suffer more from fever than the white troops; but this is probably owing to a larger proportion of the latter being stationed on the plains. The proportion, however, of deaths to admissions from paroxysmal fevers is much higher among the white troops, who appear to suffer more from continued fever.

The average death-rate of the civil population for the five years ending September 1888, was 23·0, a low death-rate for a tropical island. In the year 1884–85, out of 13,500 deaths, 2400 were registered under the five heads, ague, remittent fever, fever (unclassified), malarial fever, and congestive fever. This gives a malarial fever mortality of 4·02 per 1000 of the population. The fever deaths form a proportion of 177·7 per 1000 of the total mortality. In the year 1887–88 the malarial fever death-rate was 3·80 per 1000 living, and the proportion of deaths to the total mortality, 170·2 per 1000. The total mortality is low, but the fever mortality is excessive.

The north coast is, upon the whole, less malarious than the south, yet there are malarious *foci* of some intensity in the northern part of the island. The parishes of St. James on the north, of St. Thomas in the extreme east, and St. Catherine on the south coast, are the most malarious. The most healthy parish is Manchester in the interior. The capital, Kingston, shows a higher death-rate from malarial fever than non-malarious localities such as Manchester, but one considerably lower than malarious country districts, such as Portland, on the north-east. The following figures are for all the different forms of fever noted above in 1887–88:—

Whole Island.	Kingston.	Manchester.	Portland.
3·80	3·56	2·90	4·04

As bearing upon the nature of the remittent fever of Jamaica, it may be noticed that the non-malarious parish of Manchester shows a low death-rate from this type.

The subjoined table shows the average proportion per cent. of admissions from malarial fever, anæmia, dysentery, and pneumonia, to the total admissions in the public hospitals of the Colony for the three years 1885–86, 1886–87, 1887–88:—

	Malarial Fever.	Anæmia.	Dysentery.	Pneumonia.
Morant Bay, . . .	33·5	1·1	1·6	0·9
Hordley, ...	21·4	0·2	0·3	1·6
Port Antonio, . . .	23·8	1·4	0·3	1·1
Buff Bay, . . .	14·5	4·2	1·4	0·5
Annotta Bay, . . .	31·6	2·3	0·5	0·0
Port Maria, . . .	25·8	2·0	0·6	0·9
St. Ann's Bay, . .	6·5	3·2	0·4	1·3
Falmouth, . . .	9·5	1·1	1·6	0·3
Montego Bay, . . .	39·6	1·0	0·5	0·4
Lucea, ...	21·7	2·6	0·6	0·4
Savannah-la-Mar, . .	50·7	0·0	0·1	0·5
Black River, . . .	17·9	0·6	0·2	0·4
Mandeville, . . .	3·8	1·8	0·4	0·5
Chapelton, . . .	3·4	1·0	0·7	0·7
Dry River, . . .	2·8	0·2	1·1	0·4
Lionel Town, . . .	42·8	1·2	1·7	0·6
Spanish Town, . .	21·8	3·7	1·5	0·5
Linstead, . . .	18·3	0·3	1·0	0·3
Kingston, . . .	26·5	3·6	2·1	2·4

Respecting some of these districts, Bent, to whom we have already referred, gives some topographical details which throw light upon these returns.

Savannah-la-Mar, which ranks first in the proportion of fever admissions, is described as a "long town straggling inland through a huge swamp." We need not wonder, then, that half of the admissions are for malarial fever.

Falmouth is said to have a small sluggish river discharging itself into the sea at a short distance from the town, which imperfectly drains a large swamp stretching inland for several miles; yet it will be observed that fever is by no means prevalent in this locality. The site of the town facing to windward may account for this. On the other hand, Montego Bay is highly malarious, and was still more so before the filling up of the swamps adjoining the creek.

Mandeville, which has a very low admission-rate from fever, is situated on the table-land of the May-day Mountains, at the height of 2000 feet. It is free from swamps, and with a variable climate escapes the extremes of lowland heat and mountain moisture. Chapelton also owes its salubrity to its elevation and freedom from marshy conditions.

Of Port Antonio, where fever furnishes nearly a fourth of the admissions, Bent, in 1865, gave a favourable opinion. The barracks, being built on a small promontory jutting out into the middle of the harbour, seemed to him to be so advantageously situated as to render them suitable for permanent occupation by white troops. He had, however, overlooked its history; and the medical history of a locality should always be inquired into in such circumstances. From 1817 to 1836 the fever mortality of this apparently healthy spot was 126 per 1000; and the lapse of thirty years had not rendered it healthy, for, when it was reoccupied in 1886 by the 2nd Battalion of the 6th Regiment, the admissions per 1000 for paroxysmal fevers among the white garrison were 950, and for continued fevers 750 per 1000; while the ratio of deaths from paroxysmal fevers was 25 per 1000. In short, the detachment had to be replaced by one of black troops, which we are informed remained healthy. The medical officer reported the existence of a swamp in the neighbourhood as the origin of the sickness that affected the white troops.

So much for local conditions that seem to explain the greater or lesser prevalence of malarious disease in some of the localities. Speaking generally, the plains are more malarious than the high lands; marshy or humid districts than those that are dry and porous; but some localities prove malarious where the conditions seem to promise salubrity.

A rebellion broke out in the middle of October 1865, necessitating the removal of the troops to the plains, and their being subjected during the rainy season to fatiguing marches and to residence in temporary camps in unhealthy localities. The result was, "that in the last quarter, the average of fever admissions rose from 30 per 1000 of strength to above 400, and the mortality from 9 to nearly 22 per 1000. The patients suffered afterwards from relapses of fever, chronic debility, anæmia, and anasarca—sure evidence of the nature of the infection to which they had been exposed." In many cases "the poison lay dormant for weeks, not becoming active until after the purer air of the mountains had been regained, and the ordinary habits of life resumed."

The following table shows the effect of the three months' campaign in the last quarter of 1865, on the white and black troops respectively in raising the mortality of that year, as compared with the average of the preceding six years:—

	White Troops.				Black Troops.			
	1865.		1859-64.		1865.		1859–64.	
	Admissions per 1000.	Deaths per 1000.	Admissions per 1000.	Deaths per 1000.	Admissions per 1000.	Deaths per 1000.	Admissions per 1000.	Deaths per 1000.
Paroxysmal Fever, . .	219·6	5·86	90·1	3·09	322·9	8·83	283·4	3·25
Continued Fever, . .	188·9	5·86	63·9	1·54	68·1	1·26	16·8	1·25
Dysentery and Diarrhœa, .	48·3	...	48·9	0·26	53·0	1·26	25·5	1·00

We observe that the paroxysmal and continued forms of fever alike show an increase of frequency and fatality, as a result of the conditions we have mentioned above, to which the troops were subjected, which so far favours the view that they are essentially of the same nature. It is also to be remarked that the admissions from the continued form of fever among the black troops increased three-fold on account of the campaign; but the death-rate remained almost the same; while the increase in the admissions from this form among the white troops was accompanied by a corresponding increase in the death-rate. We further note that the black troops suffered more from dysentery and diarrhœa than did the white troops.

Phillippo informs us that intermittent fevers are common in the low lands, immediately after the rainy season in October, while remittent fever generally occurs in the summer months.[1]

Bent remarks that "the sickly periods correspond pretty closely with the rainy seasons, which set in about April and November, and last for two or three weeks, causing much malarious exhalation from the rank low lands."

The period of maximum fever mortality does not coincide, in a given year, all over the island; nor, taking the Colony as a whole, does the maximum always fall in the same quarter in different years, as will be seen by the following figures :—

	Oct.-Dec.	Jan.-Mar.	April–June.	July–Sept.
1884–5, . .	26·9	26·5	21·9	24·7
1885–6, . .	25·2	23·2	19·5	31·9

It will be seen that in 1884–85 the fever deaths attained their maximum in the last quarter; whereas, in the following year, the maximum of deaths occurred in the third quarter.

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[1] *Climate of Jamaica*, Lond. 1876.

The malarial fevers met with in Jamaica are of the intermittent, remittent, and continued types; but it is certainly open to doubt whether the continued fevers are really of malarious origin. In Kingston the hospital cases of the intermittent type are about eight times as numerous as those of the remittent kind, but the latter is eight times as fatal as the former. Bilious complications are frequently met with. Arnold relates cases, apparently of true remittent, in which purpurous spots appeared towards the end.[1] I judge, however, that the hæmorrhagic forms are less frequent than in the Southern States of the Union and in Cuba.

Enteric Fever is by no means a stranger in Jamaica. The death-rate in Kingston, for the ten years ending September 1888, from this disease averaged 2·72 per 10,000, calculated on the population of 1881. The death-rate for the whole island, however, in 1888 was only 0·88 per 10,000. It must be remembered, however, that Kingston is the only district in which the greater part (75 per cent.) of the deaths are medically certified, and it is certain that as regards the island generally these figures understate the prevalence of the disease. The enteric fever death-rate of Kingston is higher than that of England and Wales; and although the island, as a whole, is affected to a lesser extent, we may conclude that enteric fever forms an important element in the pathology of Jamaica. The disease seems to be most frequent in the second and third quarters.

Typhus is unknown in Jamaica.

Yellow Fever.—Hirsch records sixteen epidemics of yellow fever occurring in Jamaica between the years 1655 and 1877, and some of these lasted two or three years, which shows that the conditions favourable to the persistence of the disease exist in the island. It is probably always introduced, and its introduction is facilitated by the false views as to its nature that seem to prevail. Were its contagious character recognised, and quarantine regulations thoroughly carried out, this scourge would seldom visit Jamaica. Yellow fever is generally restricted to the plains; but in 1867 it broke out at Newcastle at an altitude of nearly 4000 feet.

Diphtheria gives rise in Kingston to an average death-rate of 2·77 per 10,000 living. In 1888, the mortality under the four headings of quinsy, croup, diphtheria, and cynanche maligna was 2·76 per 10,000. The mortality from these fatal throat affections is quite considerable, although less than that resulting in England from croup and diphtheria combined.

Asiatic Cholera only reached Jamaica for the first time in 1850, having been introduced from Colon. This was followed by another epidemy in the year 1854. This is the last appearance of this pestilence in the island.

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[1] Arnold's *Practical Treatise on Bilious Remittent Fever*, Lond. 1841.

Dysentery, as we have already seen from the table of hospital admissions, is generally diffused all over the island; but it is to be observed that marshy and feverish localities, such as Savannah-la-Mar, suffer less from this disease than some non-malarious places, such as Chapelton. It is chiefly met with in the western and mountainous part of the island. The death-rate from dysentery, for the whole island, in 1887–88 was 2·83 per 10,000 living; in the malarious parish of Portland it was 1·04; and in Manchester, where malaria is comparatively rare, it was 2·88 per 10,000.

Diarrhœa caused a death-rate of 9·01 per 10,000 for the whole island. The combined mortality for the two diseases was thus 11·84 per 10,000, or 1184 per million, as compared with the mortality from these two diseases in England (1881–84) of 694 per million. The diarrhœal death-rate for the whole island is not high, considering the tropical character of the island; but that of Kingston is excessive, the ten years' average being 2160 per million.

Smallpox.—Writing in 1876, Phillippo says that "smallpox has made but three visitations during the last twenty-four years." It was again epidemic in 1885–86, 1886–87, causing a mortality of about 1·5 per 1000.

Measles is only seen at distant intervals, and is mild in type. Phillippo says that there has been no epidemy of *Scarlet Fever* for thirty years.

Whooping Cough is also a rare disease in Jamaica, and is of a very mild character.

Phthisis.—The average death-rate from phthisis for the whole island, for the ten years ending September 1888, was 17·5 per 10,000 living, or 1750 per million, as compared with the English average (1881–84) of 1839. It thus appears that phthisis is less, but only slightly less, prevalent in Jamaica than in England. In some of the country districts, such as St. Elizabeth on the south-west coast, the mortality is very low; the average for the ten years in that parish being as low as 96 per million; whereas Kingston, on the other hand, must be pronounced a phthisis-stricken town, the mortality reaching the enormous ratio of 4350 per million. The death-rate from bronchitis at Kingston, for the year ending September 1888, was 3·88 per 10,000 living; that from pneumonia, 9·62; and that from pleurisy, 0·80.

The relative prevalence of pneumonia in the different parts of the island can only be inferred from the proportion which the cases of this disease bears to the total admissions in the different hospitals, as given in a previous table. Excluding Kingston, it appears to be most frequent in the eastern districts represented by Hordley and Port Antonio. Pneumonia is most prevalent in the last and first quarters of the year.

Diseases of the Liver are remarkably rare in Jamaica; the ratio of deaths from "liver disease," "jaundice," and "hepatitis" in Kingston is 1·81 per 10,000.

Diseases of the Spleen are not registered among the causes of death; the mortality from this cause being, no doubt, ascribed to malaria.

Convulsions are excessively fatal; the death-rate in 1888 having been 2406 per million, or 24·06 per 10,000.

Trismus Nascentium causes a death-rate of 140 per million.

Cancer is not at all common—the death-rate in 1888 being 1·19 per 10,000 (119 per million), or about one-fifth of the rate which obtains in England. Related to the prevalence of the malarial element is an enormous death-rate from *dropsy* (9·01 per 10,000), and a high mortality from *anæmia* (0·54 per 10,000).

Rheumatism is also very fatal in Jamaica. The ratio of deaths for the island generally, in 1888, was 290 per million; but the average in Kingston is much more moderate, being 111 per million. Even accepting the Kingston average, it is clear that rheumatic diseases are very common in Jamaica. On the other hand, diseases of the circulatory system are by no means fatal among the European troops.

Diabetes is rare.

Leprosy affects about one in 700 of the inhabitants.

Yaws is endemic in Jamaica.

Syphilis gives for Kingston a death-rate of 100·4 per million, and for the whole island one of 70 per million. As these ratios are for one year, and are derived from comparatively small populations, they must be accepted as only approximative; still they indicate that syphilis is a common and severe disease in Jamaica.

CHAPTER IV.

HAITI, PUERTO RICO, GUADELOUPE, MARTINIQUE.

HAITI, situated to the south-east of Cuba, is known to be highly malarious, especially along the coast. Port au Prince, which is situated in a level plain surrounded by marshy land, has a temperature which in November reaches 32° or 33° C. The months of heaviest rainfall are April and May. The annual fall is 1555 mm. The intermittent and remittent forms of fever alike prevail; the former assuming the tertian or double tertian type, with engorgement of the spleen. Cape Haïtien, formerly a populous town, but now reduced to a village of about 2000 inhabitants, is an endemic seat of yellow fever. Samana-de-la-mar, on the south side of the deep bay of the same name, is in the highest degree malarious. Herpes and urticaria are here often observed as complications of malarial fevers. The Spanish expedition of 1863, although composed of acclimatised troops, suffered severely from climatic affections in Haiti. The patients were transferred to the Cuba hospitals, the registers of which give the following results:[1]—

	Cases treated.	Deaths.
Intermittent Fever, ...	4089	1
Yellow Fever, ...	345	112
Rheumatism, ...	336	1
Diarrhœa, ...	1420	303
Dysentery, ...	401	85

Intermittent fever, although causing the greatest amount of sickness, occasioned little direct loss of life. The fatal diseases of the campaign were yellow fever, diarrhœa, and dysentery.

Typhoid Fever was epidemic in San Domingo in 1871–72.

Syphilis is very prevalent in Haiti.

PUERTO RICO, lying to the east of Haiti, is 100 miles from east to west, and 40 from north to south. The area, 3600 square miles, with a population of about 630,000.

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[1] Rey, *Geo. méd. nouv. dict. de méd. et de chir.*, Paris 1872.

The capital is San Juan, the mean temperature of which is 25°·75 C. The rainfall is 1839 mm. The island is traversed from east to west by a range of mountains, having an average height of 1500 feet. The country is comparatively free from marshes, is well cultivated, and, upon the whole, healthy. The annual death-rate of San Juan is said to be 21·78, and the birth-rate is 25·98, per 1000. This low death-rate requires confirmation.

PATHOLOGY. — *Malarial affections,* although not excessively frequent, are the predominating diseases of the summer.

Typhoid Fever is also met with, and appears to be by no means rare.

Yellow Fever breaks out at intervals of five or more years.[1] In 1885 it prevailed in various towns, reaching elevations of from 1200 to 1500 feet. It is said to be generally imported from St. Thomas.

Cholera made its first appearance in 1855, and caused a great mortality.

Croup is mentioned among the occasional diseases of childhood.

Measles and *Whooping Cough* are epidemic from time to time.

Smallpox is endemic in the country, especially since 1875.[2]

Catarrhal Affections are frequent during the winter months.

GUADELOUPE AND MARTINIQUE.

GEOGRAPHY AND CLIMATE.—Guadeloupe, in lat. 16° N., and long. 61° 45′ W., is a French colony. Its area is 534 square miles, with a population of about 160,000. It is divided by a narrow strait into two parts—Grande Terre, to the east, and Basse Terre, to the west. Grande Terre is low and flat; its soil is calcareous, with a layer of vegetable mould lying on a volcanic base, favouring filtration, and the collection of the rains into subterranean sheets of water. The chief town of Grande Terre is Pointe-à-Pitre, situated at the bottom of a deep bay, and surrounded by marshy land. Basse Terre, or Guadeloupe proper, is not low, as its name would imply, but consists of a volcanic mass, rising to a height of above 5000 feet. It presents an alluvial strip, fringed by marshes and mangroves on the side facing Grande Terre. The chief town, named Basse Terre, built on sloping ground, is partly low and partly elevated.

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[1] Amadeo, *Observations on Yellow Fever*, Pract. vol. xlii.

[2] Salicrup, *Archiv. de méd. nav.* vol. xxxvi.

The following, according to Dutroulau, are the mean temperature and rainfall of Guadeloupe for the year 1855:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature,	25·70	26·43	26·50	26·22	26·80	27·16	27·34	27·36	26·70	26·81	26·15	26·06
Rainfall, . . .	0·540	0·380	0·042	0·057	0·085	0·071	0·142	0·382	0·298	0·251	0·156	0·302

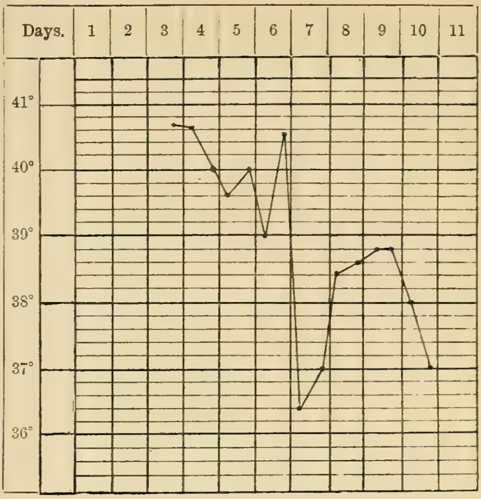
PATHOLOGY.—*Malarial Fever* is met with at Pointe-à-Pitre and Basse Terre, but is much more prevalent, as might have been expected, at the former locality. Dutroulau states that at Pointe-à-Pitre, malarial fevers form 93·10 per cent. of the total cases treated in the hospital, while at Basse Terre they form only 36·55 per 100. The very high proportion of fever cases, however, at Pointe-à-Pitre is principally due to the annual changes in the garrison bringing to it patients already affected. Still, making allowance for this, fever is more common at Pointe-à-Pitre than at Basse Terre, although the fever in the latter place seems to be more fatal. Thus in 1850, a moderately healthy year, the admissions from malarial fever at Pointe-à-Pitre were 2658, with 8 deaths; in Basse Terre, with only 628 admissions, there were 11 deaths. In 1852, when there was an epidemy of yellow fever, there were 1173 admissions at Pointe-à-Pitre from malarial fever, and 5 deaths; while at Basse Terre there were only 437 admissions, but 10 deaths. Fevers, in both localities, are most frequent and fatal in the fourth quarter.

Corre states that malaria is rare at an elevation of 120 to 150 mètres, and disappears at 500 to 600 mètres.

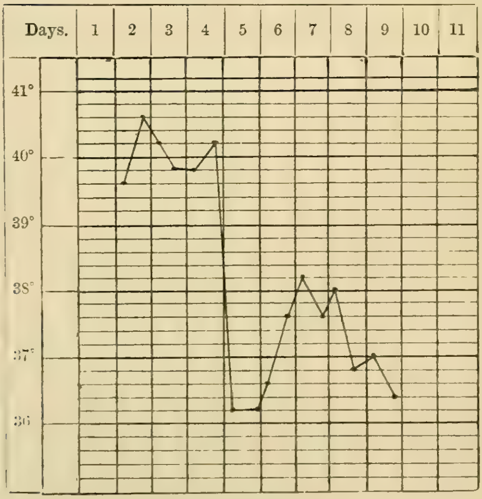
Guéguen recognises at Guadeloupe, apart from the ordinary types and modifications of intermittents and remittents, the following principal varieties of fever:—

1. An inflammatory form, commencing, as a rule, with a violent rigor followed by high fever, the temperature reaching 40° or thereabouts in twenty-four hours, and continuing to oscillate between 39°·5 and 40°·8 C., for four, five, or six days, when a rapid fall takes place, bringing it below the normal. This state of apyrexia lasts about twelve hours, and is succeeded by a second febrile movement, less severe, which lasts for two or three days. In this form there is great restlessness, but little or no nausea, and no intestinal complication. The temperature range will be understood by reference to accompanying charts 1 and 2:—

I.—INFLAMMATORY FEVER (Angiotenique).



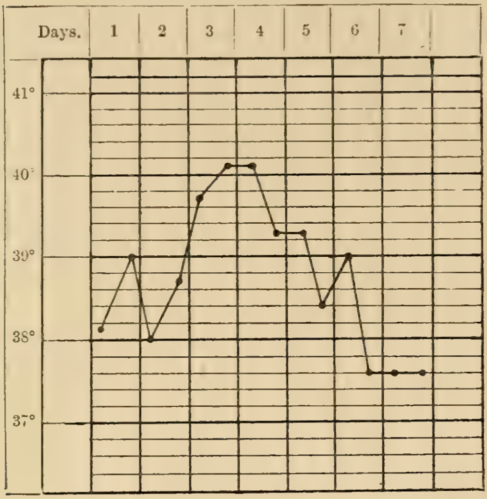
II.—INFLAMMATORY FEVER (Angiotenique).



2. A mild bilious fever, marked by a sudden rise of temperature, continuing high for twenty-four or forty-eight hours, then falling by steps of 1°·5 C. until the normal temperature is reached. This fever is accompanied by slight gastric catarrh, nausea, icterus, sometimes by bilious vomiting. There may be either bilious diarrhœa or constipation, but it has no tendency to relapse

The thermal movement is depicted in chart 3 :—

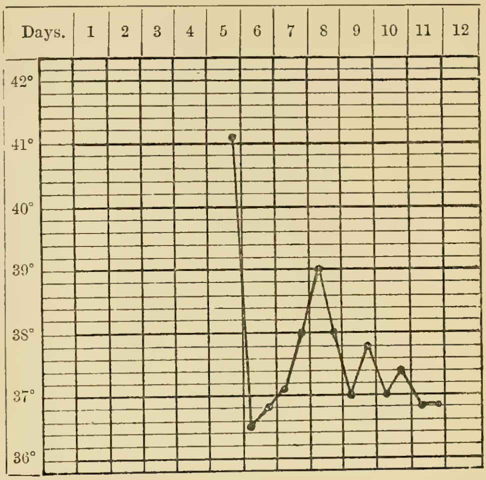
III.—Bilious Remittent (Mild).



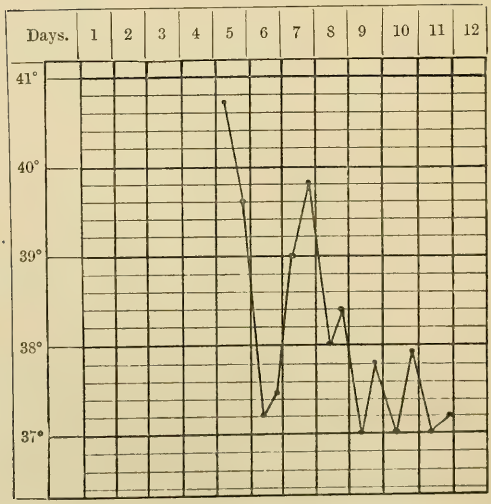
3. A grave form of bilious fever, in which the temperature rises steadily, without any remission, until it reaches 40° or 41° on the third day. It then shows very trifling morning remissions and evening exacerbations. It falls on the fifth or sixth day, and within the space of twenty-four hours comes down to some point between 36°·8 and 37°·2. The period of apyrexia lasts six or eight hours. The temperature again rises rapidly, as at the outset of the fever, reaching, in the first evening, 38°, and on the succeeding morning 39° to 39°·8. The second fastigium may only be reached in the evening. The temperature remains stationary for some hours, then falls slowly by a series of defervescences. This may be the end of the attack, or it may return a third time, or assume a tertian type. This form is accompanied by great epigastric oppression, nausea, bilious vomiting, and icterus, appearing about the third day. It is characterised by its relapses, and its tendency to induce anæmia and to terminate in an obstinate intermittent. The mild form attacks new-comers; the grave form attacks natives as well as Europeans, and is met with in all marshy localities.

The grave form may be associated with subconjunctival ecchymoses, petechiæ, with determination to some organs, such as the liver, kidney, or the nervous centres, and not unfrequently it ends in collapse. Charts 4, 5, and 6 :—

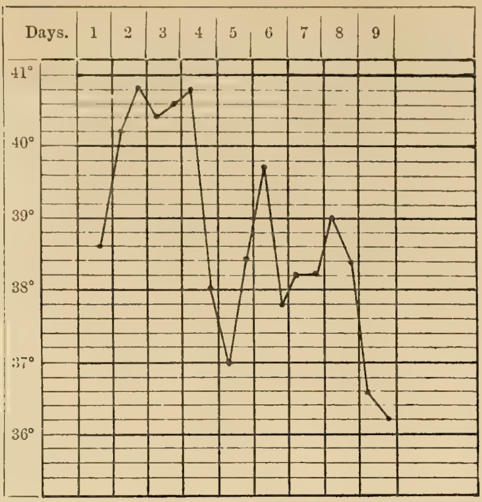
IV.—Bilious Remittent (Grave).



V.—Bilious Remittent (Grave).

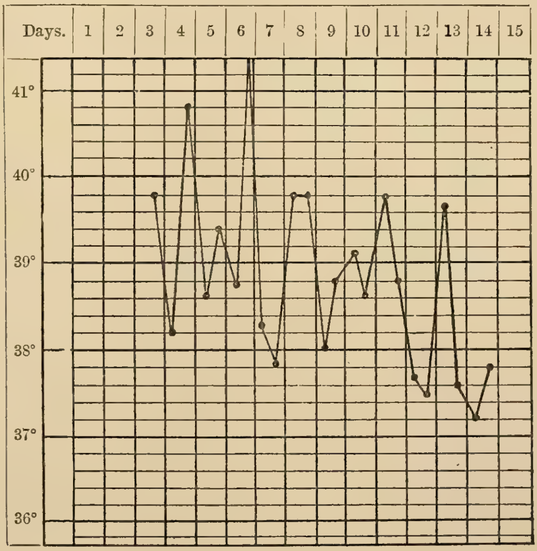


VI.—Bilious Remittent (Grave).

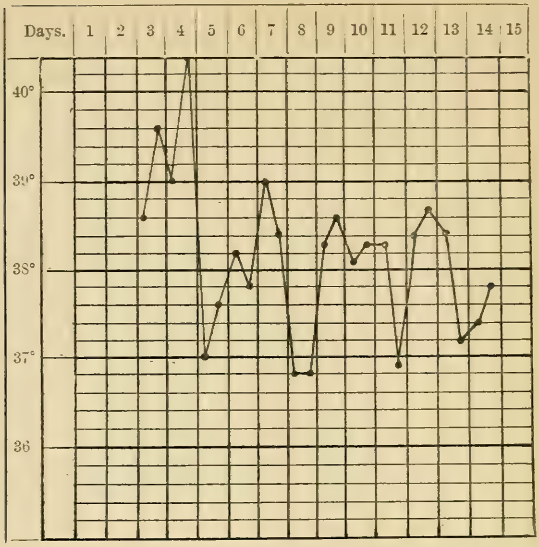


4. Typhoid remittent, in which the temperature rises by successive zigzag movements until, in the afternoon of the fourth day, it attains the height of 40°. The maximum having been attained, it then follows a remittent course of a tertian type. Defervescence takes place on or about the thirteenth day. Charts 7 and 8 :—

VII.—Typhoid Remittent.



VIII.—Typhoid Remittent Form.



5. Hæmoglobinuric fever occurs in Guadeloupe, in Creoles and old residents; and is generally the result of a chill, in persons saturated with malaria.

True *Typhoid* is endemic in Guadeloupe; and has been observed in an epidemic form at Camp Jacob, at a height of 500 mètres.

Yellow Fever has frequently broken out in the island—fourteen epidemies having been recorded between 1635 and 1870.

Dysentery is common in Guadeloupe, and it may be remarked that it is more frequent at Basse Terre than at the marshy station of Pointe-à-Pitre.

Hepatitis is rare, not only as compared with its frequency in the East Indies, but even as compared with Cuba and Haiti.

Phthisis makes many victims among the coloured population. It is believed that *Pneumonia* is less frequent here than in some of the other islands; but exact information is wanting.

Leprosy is endemic among the coloured population.

Yaws is also common.

MARTINIQUE.

Martinique, situated about 100 miles to the south-east of Guadeloupe, is about 40 miles long by 12 broad. The south-east part of the island is low, and its shores are indented by numerous bays and river-mouths. This district consists of low plains of considerable extent. The north-west part of the island is elevated and rugged—the volcanic peaks of Carbet and Pelée rising to a height of 4000 to 5000 feet.

The capital, Fort-de-France, placed on the shores of a deep bay, is built on alluvial ground, at the sea-level, and is exposed to the winds from the most unhealthy quarter. St. Pierre, the commercial town, is built on sloping soil, backed up by a hill which rises like a wall between the town and the east winds.

PATHOLOGY.—Dutroulau, from whom these topographical details are taken, says that St. Pierre is comparatively free from malaria, while Fort-de-France, on the other hand, is highly malarious. He gives the proportions of admissions from fever to total admissions as 35·08 per cent. in the case of Fort-de-France, and 25·30 per cent. for St. Pierre, and adds that the fevers observed at the latter place have mostly been contracted elsewhere. Fort-de-France seems also to suffer from dysentery more than St. Pierre.[1] Dr. St. Vel[2] gives by no means so favourable an account of this town as that given by Dutroulau. At St. Pierre, he says, fevers exist all the year round in an endemic form, and in certain years they take an epidemic character, and augment in gravity. When yellow fever appears, the endemic fevers are observed to be more frequent and grave among the natives. But sometimes, as in 1859, when there is no yellow fever, the endemic fever may become general. St. Pierre and its environs have none of the characters of a marsh, and yet intermittents are there very frequent; but the malarial cachexia and the pernicious algid are not seen, while intermittents, remittents, pseudo-continued, masked forms, the pernicious comatose, the grave fever, with jaundice and black vomit, are met with daily.

Yellow fever has been frequently epidemic in Martinique. No fewer than twenty-two outbreaks are recorded as having occurred between 1688 and 1869, and it was again epidemic in 1880 and 1888. Clarac, from his observations of the two last-mentioned outbreaks, came to range himself on the side of those who, without denying the importation of the disease, consider that it also arises spontaneously in Martinique from time to time.[3]

The pathology of Martinique, otherwise, is so similar to that of Guadeloupe that it is unnecessary to enter into further details.

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[1] We may observe that Dutroulau remarked that the soldiers in the garrison of St. Pierre, who had been supplied for several years with rain-water for drinking, suffered as much from dysentery as they did previously.

[2] Saint-Vel, "Of the Nature and Treatment of the Fever of St. Pierre, Martinique," *Arch. de méd. nav.* vol. xvi. p. 401; also, *Traité des maladies des regions intertropicales,* Paris 1868.

[3] *Archiv. de méd. nav.* 1886.

Both in Guadeloupe and Martinique, colic is returned among the endemic maladies. The dry colic of French authors is now generally regarded as due to lead poisoning. It is deserving of remark, that Sydenham[1] notices that colica pictonum "is extremely common in the West Indies, where it destroys many persons." Why it should be so frequently met with in this part of the world is not very evident.

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[1] Sydenham, *Processus Integri*, cap. xxv.

CHAPTER V.

THE LEEWARD AND WINDWARD ISLANDS, TRINIDAD.

The Leeward Islands of Antigua, Montserrat, St. Kitts, Nevis, Anguilla, Dominica, and the Virgin Islands form a federal Colony belonging to Britain.

The Windward group comprises Barbadoes, Grenada, St. Vincent, Tobago, St. Lucia, and Trinidad; the last will be considered separately.

The climate of these islands differs little from that of Jamaica and Trinidad. The mean temperature of the year at Barbadoes is 80° F.; the hottest month (October) is 83°, and the coldest month (January) is 78°; the mean yearly fluctuation is 5° F. (Parkes).

Malaria.—The islands of Barbadoes, Montserrat, and Anguilla are remarkably free from malarious diseases. St. Lucia, which is in part swampy, is not free from fever. Intermittents and bilious remittents are rather frequent at Tobago[1] and Antigua.[2] The other islands are moderately healthy.

Typhoid Fever, although not very prevalent, is met with in both groups. *Yellow Fever* has been their great scourge, although it is doubtful if it is endemic in any of them. Hirsch records thirteen epidemics in Barbadoes between 1647 and 1867, and an equal number in Antigua between 1729 and 1858. St. Vincent, St. Lucia, and Tobago have suffered less frequently, although the first two are looked upon by some as endemic *foci* of the disease. As regards Barbadoes, the list of outbreaks is not complete, but of late years it has appeared less frequently than formerly.

Dysentery and *Diarrhœa* are amongst the commonest diseases in these islands. In Tobago dysentery is said to be neither common nor severe.

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[1] Hay, *Handbook of the Colony of Tobago,* 1884.

[2] Day, *Five Years' Residence in the West Indies,* Lond. 1852.

Smallpox and *Whooping Cough* have from time to time been very bad in Barbadoes (Parkes).

Rheumatism is stated to be common in Tobago, Antigua, and Barbadoes.

Elephantiasis, or "Barbadoes leg," is endemic, not only in Barbadoes, but in most of the other Leeward and Windward Islands.

Leprosy is met with in Barbadoes, St. Kitts, Nevis, Antigua, and St. Vincent.

TRINIDAD.

GEOGRAPHY.—Trinidad lies opposite the coast of Venezuela, between 10° 3′ and 10° 50′ N. lat., and between 61° 39′ and 62° W. long. It is separated from the mainland by the Gulf of Paria. Its area is 1754 square miles, and its population, in 1881, was 153,128. Mountain ranges of no great elevation skirt the northern and southern shores, while the Tamana Hills (1025 feet) occupy the centre. The rest of the island consists of fertile plains of considerable extent. The capital is Port of Spain, on the north-west coast, with a population of 32,000. On the same coast, but 30 miles to the south, is San Fernando, with 6335 inhabitants.

Many districts are swampy, especially along the shores. The lower stretches of the Ortoire are low and flat. The coast of County Mayaro is traversed by small streams, forming lagoons at their mouths. The Caroni River forms a swampy delta, and some of its tributaries overflow their banks. From the south-east boundary of Port of Spain to the ward of Chaguanas, for about 11 miles along the seashore, and from 3 to 4 miles inland, extends an immense mangrove swamp, and farther inland is the Grand Savana. This latter covers an area of several miles (say 20,000 acres), more or less completely submerged during the rains, and to such an extent as to prevent communication across it. East of Port of Spain lies Laventille, which merits the reputation of being one of the most unhealthy districts of Trinidad. This character it is supposed to owe to its proximity to an extensive mangrove swamp. No white man, it is said, can live there. The ward of Cimaronero is also unhealthy, but less so than Laventille. The Oropuche lagoon, 14 square miles in extent, is an inexhaustible source of malaria. Mucurapo and Cocorite are also in many places marshy. These topographical details, derived from Verteuil's work, show that paludal conditions are very prevalent in Trinidad.[1]

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[1] Verteuil's *Trinidad*, Lond. 1884.

CLIMATOLOGY.—The mean of the maxima and minima temperatures are :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Min. Temp., .	74·40	73·00	77·60	79·60	79·20	79·00	80·00	80·00	80·40	79·60	79·00	76·40
Mean Max. Temp., .	86·00	86·60	89·00	91·00	93·20	90·20	89·60	91·60	92·00	90·60	89·40	87·80

The dry season extends from the middle of December to May; the driest months being February, March, and April; the heaviest rains are in August, September, and October. The annual rainfall is about 60 inches.

PATHOLOGY.—*Malaria.*—The admission-rate from malarious fevers among the troops has of late years been low, although St. James' Barracks, placed on the right bank of the Mucurapo River, and about 2 miles from Port of Spain, are built on an alluvial plain, and in the vicinity of marshes of some extent. During the early part of this century the mortality from fevers at this station was very high, reaching 61·6 per 1000 for the period 1817–36 (Parkes).

The average admissions and deaths from all fevers among the white troops for the four years 1864–67 were as follows :—

	Admissions per 1000.	Deaths per 1000.
Intermittent Fever, ...	143·4	0·0
Remittent Fever, ...	12·1	2·8
Continued Fever, ...	105·7	1·3

Some doubt exists as to the nature of the continued fever reported from this station. The small mortality militates against the view of its enteric character, although, as we shall see, enteric fever does exist in the island. During some years the remittent type is more prevalent than these figures would indicate. Thus, in 1881, remittent fever caused 62 admissions and 7 deaths. The strength is not given; but, as the average strength during the four years 1864–67 was 198, we shall probably be near the point if we assume that it was about 200. This would give an admission-rate of 310, and a death-rate of 35 per 1000. There was no yellow fever in the Colony that year, but this disease was at that time epidemic in Barbadoes. We have seen that when yellow fever is epidemic in Martinique, remittent fevers are also unusually prevalent. Is it possible that, in 1881, some general influence extended over the whole of this region, manifesting itself by an epidemy of yellow fever in the island of Barbadoes, and by an unusual frequency of remittent fever in Trinidad? If so, we must observe that this influence did not alter, and did not intensify the character of the remittent fever, for it occasioned its usual percentage of deaths among the cases treated, that is, about 10 per cent.; whereas in Barbadoes, that same year, the percentage of deaths among the cases of yellow fever treated was 62·1. By referring to British Guiana, it will be seen that malarial fever sometimes assumes unusual virulence in years when yellow fever is epidemic.

The civil population suffer extensively from malarial fevers in certain localities. Verteuil states that the districts most liable to fever "are those skirting the sea, or lying to the leeward of swamps;" the interior districts may be said to enjoy comparative immunity. Intermittent and remittent fevers form about 13 per cent. of the total admissions into the Colonial Hospital of the Port of Spain.

Apoplectic and algid symptoms occasionally supervene from the third to the fifth day, either of the intermittent or remittent types. Verteuil remarks that nearly all the diseases of Trinidad—no matter what may be the nature of the complaint—have a tendency to assume the remittent or intermittent form. He notices the frequency of intermittent sore throat and dysentery, and states that remittent pneumonia is not rare.

Enteric Fever is not of frequent occurrence in Trinidad, unless we are to suppose that it is confounded with the continued forms of malarial fever. As a matter of fact, where malaria is very prevalent, enteric fever is very apt to be overlooked. Be this as it may, I observe that no case of enteric fever was treated in the Port of Spain Hospital in 1888. A severe epidemy of the disease occurred in 1866–67.

Yellow Fever is not endemic in the Colony. Hirsch records six epidemies from 1793 to 1869.

Smallpox appears in an epidemic form at intervals of twelve years or longer.

Scarlet Fever and *Measles* are known, but their epidemic visitations are rare, and both the diseases are milder than in Europe.

Whooping Cough is of more frequent occurrence, but not dangerous.

Diphtheria, which is said to have been formerly almost unknown in the island, has during late years appeared in occasional epidemies, which have caused a great mortality.

Croup is of rare occurrence, but œdematous sore throat is rather common, and often proves fatal by the œdema extending to the glottis.

Dysentery is endemic and epidemic in Trinidad, where, next to malarial fever, it is the most prevalent disease. Verteuil states that while it is endemic in certain localities, especially where the country is liable to inundation, it appears every ten or twelve years in an epidemic form. It is most prevalent at the beginning of the wet season, viz. in July and August, often after the first heavy showers.

Phthisis is stated to be no uncommon malady in Trinidad, running very rapidly to a fatal termination (Verteuil).

Bronchitis, Tracheitis, and *Laryngitis* are of moderately frequent occurrence, and it is remarked that they are principally met with when chill northerly winds prevail.

Pneumonia and *Pleurisy* are rare in Trinidad.

Hepatitis, which we have seen is rare in Jamaica, is rather prevalent in this Colony, and liver abscess is not an uncommon consequence of the disease.

Inflammation of the Lymphatic Glands and Vessels is very common.

Yaws affects the children of the African race.

Leprosy is met with among all races. Italians, Poles, Englishmen, and Irishmen are all liable to become affected after a few years' residence; but it is most common among the Portuguese and Hindu immigrants.[1] In 1887, the number in the asylum was 176.

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[1] *Lancet*, 8th July 1876.

CHAPTER VI.

SOUTH AMERICA.—COLOMBIA AND VENEZUELA.

COLOMBIA.

GEOGRAPHY AND CLIMATE.—Colombia, called also the United States of Columbia, stretches on the Pacific from Panama to Ecuador, and along the Caribbean Sea to Venezuela, while on the south-east it is partly continuous with Brazil. The country is intersected by three ranges of the Andes, which diverge from each other towards the north. Between the eastern and central ranges is the valley of the Magdalena, which river falls into the Caribbean Sea east of Cartagena. Between the central and western ranges is the valley through which the river Cauca runs to join the Magdalena near its mouth. A fourth and lower chain runs along the shores of the Pacific, between which and the western Cordilleras is the valley of the river Atrato, which falls into the Gulf of Darien.

The eastern Cordilleras consist of elevated table-lands. It is here that the capital, Santa Fé de Bogota, is placed at an elevation of 8694 feet. The mean annual temperature of Bogota is 14°·4, and this scarcely varies more than one or two degrees in the different seasons. The annual rainfall is 1878 mm., distributed as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
137	107	89	241	187	100	92	118	86	231	300	190

The area of Colombia, including the State of Panama, is 513,783 square miles, and the population is reckoned to be about 4,000,000, the half of whom are of European descent.

PATHOLOGY.—*Malaria.*—Malarial diseases prevail along the Caribbean coast, from the Gulf of Darien to the Gulf of Maracaybo.

Cartagena, the most important town on this coast, is very unhealthy; as, indeed, are all the towns along this coast, which is as much the result of hygienic neglect as of climate. Malarial fevers abound in many parts of the Bolivar and Magdalena districts. The Pacific coast is more healthy, while the temperate and cold regions of the interior are free from fever.

Yellow Fever—The Atlantic coast is subject to frequent epidemies of yellow fever. Respecting the other diseases of this country very little is known. One malady is peculiar to Colombia; this is the "Pelade," a disease caused by the ergot of maize, leading to falling of the hair and sometimes to falling out of the teeth.

Leprosy is endemic both on the coast and in the interior.

Goitre is also endemic "throughout almost the whole valley of the Rio Magdalena, from Neyva in the 'tierra fria' downwards through Santa Fé de Bogota, Maraquita, Honda, and other districts as far as the plain of Pinto, at the confluence of the Cauca and Magdalena. Neither in the lower basin of the latter river, nor in the parallel valley of the Cauca, nor in the mountainous province of Antioquia between the two, do goitre and cretinism occur." (Hirsch.)

VENEZUELA.

Geography and Climate.—Venezuela, or Little Venice, in the north-east of South America, lies between 1° 20′ and 12° 25′ N. lat., and between 59° 45′ and 73° 17′ W. long. It extends along the Atlantic coast from the Gulf of Venezuela to the mouths of the Orinoco, where it touches British Guiana. On the south-east and south are British Guiana and Brazil; on the west, Colombia. Its area is estimated at 566,159 square miles, with a population of 2,121,988. The Andes enter the north-west corner of Venezuela, and divide into two ranges. The one runs almost directly north, forming the boundary between Venezuela and Colombia; the other range, called the Sierra Nevada de Merida, rises to a great height, and runs to the north-east towards the coast. Between these two ranges lies the Lake of Maracaybo, into which most of the streams in this region fall. The range of the Sierra Parime separates Venezuela, in part of its extent, from Brazil. The country south of the Merida range belongs to the basin of the Orinoco, which begins to form a delta 130 miles from its mouth.

The coast for the most part is low and marshy; and marshy tracts of great extent border the rivers; but the interior rises into elevated table-lands or *llanos*, so that, as we ascend from the coast line up to elevations of 5000 to 8000 feet, we have every variety of climate. The temperature on the coasts is very high; the mean annual temperature of Maracaybo is 29° C., the extreme months being January, 27°·3, and August, 30°·5 C. Van Leent gives the mean temperature of the island of Curaçoa, off the north coast of Venezuela, at 28° C., and he states that the rainy season is from July to October.

PATHOLOGY.—Our information respecting the diseases of this country is very limited.

According to Van Leent,[1] the island of Curaçoa consists of a rocky bottom, covered by a thick stratum of fossil shells, over which is a thin layer of humus. The rainfall is scanty, and there are no watercourses or marshes.

The island, notwithstanding its tropical heat,—and it is one of the hottest countries of the world,—is free from intermittent fever.

Lombard states that the towns of Cumana and Coro, where the rains are scanty and the soil sandy, are healthier than the rest of the coast. Puerto Cabello and Caracas are notably unhealthy.

Respecting Maracaybo, Lombard says, on the authority of Velasco, that yellow fever is endemic here and malaria very rare, while in the two neighbouring small towns, Rita and Puertos de Altagracia, yellow fever is almost unknown, and malaria is intense. The inhabitants of these villages, we are told, contract yellow fever when they visit Maracaybo, but do not communicate it in their own districts. Here, probably, there is some confusion between true yellow fever and malarial fever.

Humboldt mentions the prevalence of malarial fevers in the rich valleys of Aroa, Yaracny, and Rio Tocuyo; and in the barren savannahs of Moonai and Carora, and from Barquisemeto to the eastern shore of Lake Maracaybo; also in the villages of Aturès, Maypures, and Carichana, near the cataracts of the Orinoco, in a bare and rocky district, which shows that marshy conditions are not essential to the development of malaria.

Yellow Fever has repeatedly appeared at Guayra, and once, according to Hirsch, at Puerto Cabello and Angostura. It is probable that Maracaybo also suffers from time to time.

Goitre is endemic in the basins of the Meta and Apure, in the mountain range of the Nevada de Merida, but it is absent from the basin of the Orinoco. Venezuela was visited by *Cholera* in 1855.

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[1] *Archiv. de méd. nav.* vol. xxiv.

CHAPTER VII.

BRITISH GUIANA, DUTCH GUIANA, FRENCH GUIANA.

BRITISH GUIANA.

GEOGRAPHY AND CLIMATE. — British Guiana extends from the Orinoco to the Corentyn River, by which it is separated from Dutch Guiana. It is bounded on the west by Venezuela, and by Brazil on the west and south.

The coasts are low and flat, the soil a rich alluvium. The inland width of the fertile coast varies from 10 to 40 miles. The interior is mountainous, covered with dense forests and inhabited by a few Indian tribes.

The boundaries of the Colony on the west and south are not well defined, but the area is estimated to be about 109,000 square miles. The population in 1887 was 277,038, mostly negroes, Creoles, and Indian coolies.

The Colony comprises the Settlements of Essequibo, Demerara, and Berbice, named after the three principal rivers. Georgetown is the capital, with a population, in 1881, of 47,175.

The following is the monthly mean temperature F. of Georgetown:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
79·2	79·0	79·8	80·6	80·7	79·8	79·3	79·0	81·5	80·0	80·3	79·0

The seasons are divided as follows:—

Long dry season.	From the end of August to the end of November.
Short dry season.	From the middle of February to the middle of April.
Long wet season.	From the middle of April to the end of August.
Short wet season.	From the end of November to the middle of February.

The average rainfall in Georgetown is from 80 to 100 inches.

PATHOLOGY.—*Malaria.*—When white troops were stationed in the Colony, the fever admission-rate varied extremely, as did also the proportion between the different forms of fever.

	INTERMITTENTS.		REMITTENTS.	
	Admissions per 1000.	Deaths per 1000.	Admissions per 1000.	Deaths per 1000.
1859, ...	98·0	0	475·0	0
1862, ...	1104·1	0	48·1	0
1863, ...	318·5	0	59·2	0
1865, ...	1220·0	7·9	984·2	55·1

It will be observed that for the first three years, although the number of admissions was in one year very considerable, there were no deaths; whereas in 1865 the death-rate from the intermittent type was high, and that from the remittent type altogether excessive. The only thing that is to be remarked about that year is, that yellow fever was rather prevalent in the Colony and among the shipping, although only five cases, with one death, occurred among the troops. While the white troops suffered so much during that year, the black troops remained healthy. Since then the Colony has been garrisoned solely by black troops.

Malarious fevers are widely diffused among the civil population. The admissions from malarial fevers and the malarial cachexia to the total admissions from all diseases (except surgical), in the Demerara and the Essequibo Public Hospitals, for the years 1886, 1887, and 1888, averaged about 12 or 13 per cent.

The mortality from malarial fever is usually low, but varies considerably, becoming higher, apparently, in the years when cases of yellow fever occur. The average percentage of fever deaths to the total deaths in the Demerara Hospital for 1886 was 1·5; in 1887 it was 3·0; but for 1888 it rose to 5·1. We observe that in 1888 there were five admissions for yellow fever and four deaths; whereas, in the two previous years, there were no admissions for yellow fever. In the Essequibo Hospital, the average of fever deaths to the total deaths for 1886 and 1887 was 2·5 per cent.; in 1888 it was 3·7 per cent.

Respecting the interior, our information is scanty. Im Thurn says that on the Essequibo, above the Warrapoota Cataracts, fevers are especially prevalent; but he adds, "that they are rarely dangerous to those of good constitution and who lead a temperate life."[1]

Waterton, in his travels in the interior, suffered from fever, but not of a dangerous character; and it is certain that he could not with equal impunity have undergone the same fatigue and exposure on the coasts of Africa.[1]

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[1] Everard F. im Thurn, *Among the Indians of Guiana*, London 1883.

Enteric Fever was formerly supposed to be entirely absent from the Colony, and it must undoubtedly be regarded as comparatively rare. Dr. Grieve stated at a meeting of the British Guiana[2] branch of the British Medical Association, in 1890, that "there is not on record a history of a clear and unmistakeable case of specific enteric fever of local origin." Dr. Ferguson has, however, more recently published the details of ten cases of this fever observed by him in the Georgetown Hospital, the diagnosis of which, in some instances, was verified by the autopsy; and in some, at least, of the cases that recovered the symptoms were such that no doubt of their enteric nature can be entertained. The temperature curve in some instances differed from that which has come to be regarded as the normal curve of the disease, rigors occurring during the first week of the fever. The cases observed were all in coloured persons.[3]

Yellow Fever.—I am unable to say whether yellow fever should be looked upon as endemic in British Guiana. Sporadic cases, returned as yellow fever, are met with at times even when the disease is not epidemic, but these are possibly malarial. The epidemies of the disease recorded by Hirsch as having occurred between the years 1793 and 1866 are fifteen in all—and some of these lingered on for several years. Thus the latest epidemy noticed by him is said to have persisted from 1861 to 1866.

Epidemic Cerebro-spinal Meningitis has not, so far as I can learn, been observed in the Colony, but it appears to be not unfrequent among the coolies during the voyage from India to the West Indies.

Simple Continued Fever, which is believed not to be of malarial origin, is not uncommon. There is seldom any cold stage in this fever; the hot stage lasts from a few hours to two or three days. There is usually no terminal sweating stage, although sweats occur during the course of the hot stage. Quinine has no influence on this disease.

Dysentery is given as the cause of 57 admissions and 24 deaths in 1889 out of a total of 6730 treated, and out of 932 deaths from all causes. The admissions from dysentery thus form a ratio of 8·4 per 1000 admissions, and the deaths of 25·7 per 1000 of the total deaths. This does not seem to indicate any great frequency or fatality of the disease. But we find under the heading "Enteric Ulceration and Catarrh," 84 admissions and 34 deaths; and again, under the heading "Enteritis," 68 admissions and 15 deaths. While typical acute dysentery may thus be comparatively rare, the graver forms of intestinal disease are very prevalent and fatal, forming 78 per 1000 of the hospital mortality.

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[1] Waterton, *Travels in Guiana*, London 1889 (Reprint).

[2] *British Guiana Medical Annual*, Demerara 1890.

[3] *Ibid.*

Diarrhœa, in the same year, was the cause of 63 admissions and of 6 deaths out of the totals given above. Diseases of the intestinal canal thus occupy a leading place in the pathology of British Guiana.

The *Eruptive Fevers* are much less prevalent and fatal in Guiana than in Europe.

Pneumonia.—Respecting this disease, Dr. Grieve, in the address already quoted, says, " Acute inflammation of the lung tissue is far from uncommon in this Colony, and it appears certain that this seldom comes from exposure to climatic changes: it is either of malarial or septic origin. The history of the outbreaks of the disease, as they have occurred at times in various localities, points to their extension being due in many instances to communication from person to person; they are local epidemies of contagious pneumonia." Pneumonia, which is most frequent in males of the black and coolie races, gave rise to 7·6 per cent. of the total hospital deaths in 1886, to 3·6 per cent. in 1887, to 2·9 per cent. in 1888, and to 5·5 per cent. in 1889.

Pleurisy is not a prevalent malady in British Guiana. In 1887 it occasioned 2 deaths in hospital out of a total of 975 deaths from all causes; and in 1889 there was one fatal case only in a total of 932.

Bronchitis is rare and mild; the admissions and deaths from this disease are remarkably few.

Phthisis was formerly extremely rare in the Colony. Hancock, writing in 1835, says: "Tubercular consumption is unknown on the coast, and is extremely rare in the mountain regions, though not unfrequent on the llanos.[1] Dalton, in 1855, remarks that "phthisis rarely originates in an individual born and reared in British Guiana."[2]

Ferguson, who has lately examined this subject very carefully,[3] shows that a steady increase in consumption has taken place during recent years. While the percentage of deaths from phthisis to the total mortality in the Georgetown Hospital was 4·9 per cent. in 1846, and 2·04 per cent. in 1847, it has risen to 27·1 and 28·5 per cent. in 1886 and 1887 respectively.

The same increase is observed in the Berbice Hospital, where the proportions during the three decades 1850–79 were as follows:—

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[1] Hancock, *Observations on the Climate of British Guiana*, London 1835.

[2] Dalton, *History of British Guiana*, London 1855.

[3] *Georgetown Hospital Reports*, 1887.

Ten years ending 1859,	. . . . .	6·6 per cent.
,, 1869,	. . . . .	7·7 ,,
,, 1879,	. . . . .	13·2 ,,

A steady, though less considerable, increase in the proportion of deaths from phthisis appears in the Registrar-General's returns for the whole Colony. In 1869 to 1873 the proportion of deaths from phthisis to the deaths from all causes was 6·8 per cent., from 1874 to 1878 it was 7·6 per cent., and from 1879 to 1883 it was 7·9 per cent., as against 9·2 per cent. in England in 1884. As a large proportion of the deaths in the country districts are not medically certified, many deaths returned under such headings as debility are believed to be really due to consumption. The death-rate from phthisis in British Guiana, as a whole, in 1886 was 2 per 1000 living, and this must be regarded as the minimum. This proportion is higher than that of England and Wales. The death-rate of Georgetown from consumption is excessively high—a calculation based on the Report of the Registrar-General for 1886, places it at 7·5 per 1000 living, or 15·4 per cent. of the total mortality.

Grieve ascribes this extraordinary prevalence of consumption in Georgetown chiefly to overcrowding, there being no less than 50 to 53 persons per acre in the town. This would give about 0·02 of an acre to each person, which was precisely the density of the population of London in the decade 1871–80; yet the death-rate of London from phthisis during that decade was only 2·57 per 1000. Overcrowding, although no doubt an important cause of the great prevalence of consumption in Georgetown, cannot be the sole cause of a mortality three times that of London.

The coolies seem to be the race most liable to the disease, but the black, mixed, and white populations all suffer from phthisis to a large extent. Among the negroes the disease runs a rapid course, while in the Indian coolie its progress is usually slow.

Hepatic Affections are by no means prevalent. I find that there were 21 admissions for liver abscess during the four years 1886–89 out of nearly 30,000 cases treated.

Cirrhosis of the Liver is most frequently met with in male Indians.

Rheumatism is of frequent occurrence; but, so far as can be judged by the hospital records, it is not fatal.

Anœmia is very prevalent in British Guiana. This is to be accounted for by the existence here of various causes tending to produce an impoverished state of the blood. First of all, there is the tropical climate, which has its influence in this direction; then malaria plays a still more important *rôle* in destroying the red corpuscles; *Bright's Disease* further contributes to increase the number of anæmics; and lastly, we have to note the almost universal prevalence of the *anchylostomum duodenale*, which probably counts for something in this respect, although Dr. Ozzard seems to think that its share in the production of anæmia has been somewhat exaggerated. Cases answering entirely to the classical descriptions of *cachexia aqueuse* are said by Ozzard to be met with, in which the most careful and diligent search does not reveal the presence of a single parasite.

Although I have not, as a rule, noticed the affections of the kidneys in this work, it is impossible to pass over what forms the most remarkable feature in the pathology of British Guiana. *Bright's Disease*, especially that form known as the granular contracted kidney, is so common, that it is a rare circumstance to find a healthy kidney at autopsies. It is especially common among the black population; and less so, but still frequent among the Indians. It gives rise to a ratio of from 21 to 28 per cent. of the total hospital mortality. The explanation of this extraordinary prevalence of kidney disease has still to be found. At present some incline to regard it as in great part the result of malaria.

Leprosy is very prevalent among the coloured population. In 1888 there were 383 males and 98 females under treatment in the two leper asylums of the Colony.

Elephantiasis is of rather common occurrence. The admissions into the Demerara hospital under this heading in 1889 numbered 61.

I find no mention of *Goitre* in any of the reports. A certain number of cases of *Struma* and *Scrofula* are recorded, but I am unable to judge of their prevalence among the population as compared with Europe. It would have been interesting to know if scrofula has increased of late years proportionally to phthisis.

Cancer is met with, but it cannot be said to be common. In 1887 there were 40 admissions for malignant diseases of all kinds out of a total of 9500. The deaths formed 2·1 per cent. of the total hospital mortality in 1886; 2·01 in 1887; and 3·0 in 1888.

Syphilis gave rise, in 1888, to 318 out of a total of 6930 admissions, and to 25 deaths, excluding those due to hereditary disease. It affects all races alike.

DISEASES OF THE ABORIGINES.

The aborigines have at various times suffered severely from *Smallpox*. In 1841 it was very prevalent, and again in 1854, when it made many victims among the unvaccinated. This outbreak of smallpox was followed by an epidemy of *Measles*. The number attacked was very large. There seems to be a law of epidemic association between measles and smallpox, when they occur at long intervals in isolated communities.

Cholera affected the whole Colony in the early part of 1857. In Trinity parish, we are told, about a twelfth part of the population was attacked, and about a third of those attacked died—the sufferers being chiefly Africans and Hindoos. From thence it spread into the interior, and decimated the Indians on the Pomeroon and Berbice Rivers.

Dysentery appears to be a frequent cause of death among the Indian tribes of the interior.

Caribi or *Indian Sickness.* Brett gives the following account of this singular complaint: "In the year 1856, the ranks of our Arawâks were further thinned by a sore disease, an epidemic known by the name of the 'Caribi' or 'Indian sickness.' As it is chiefly confined to the aborigines, few medical men have witnessed it, but it is really one of the most frightful and deadly scourges which affect the Indian tribes. It is highly infectious, and when it seizes a person, eats its way upward through the rectum and other intestines until the sufferer dies"[1] (p. 223). This disease appears to be met with in Brazil under the name of "Él Bicho," and a similar complaint is fatal in Fiji.

Consumption is said to be "rare among the whole aboriginal race, even when living in these low-lying districts of the interior of Guiana, the climate of which differs in no material respect from that of the coast."[2] On the mountainous districts of the interior it also appears to be rare; but more exact information is necessary upon this point. Thurn says that the commonest forms of death among the Indians are consumption, dysentery, and a horrible disease known as the "buck-sickness" (another name for Caribi sickness).[3]

DUTCH GUIANA.

GEOGRAPHY AND CLIMATE.—Dutch Guiana or Surinam lies to the south-east of British Guiana, and is separated on the east from the French Colony of Cayenne by the river Maroni. Its area is estimated at 45,000 square miles. Its population in 1875 (exclusive of about 17,000 aborigines) was 51,834, of whom only 713 were Europeans. The coast country is low and flat, being in many places only from 3 to 10 feet above the sea-level, but rising in the interior, which is mountainous, and where considerable altitudes are attained. The littoral, for several leagues inland, is formed of thick layers of marine crustacea, covered by sand or clay. In the interior are sandy plains or savannahs, covered with a layer of humus. The chief river is the Surinam; but there are numerous smaller rivers, which, like the Surinam, are liable to overflow and form deposits of mud along their banks, especially near their mouths. The capital, Paramaribo, situated on the western bank of the Surinam, had a population, in 1875, of 21,755. Nickerie, at the mouth of the Corentyne, is a port of some importance.

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[1] Brett, *Indian Tribes of Guiana*, London 1868.
[2] Ferguson, *Op. cit.*
[3] *Op. cit.*

Paramaribo is built on a soil formed of marine crustacea. In the neighbourhood are thick forests and swamps.

The seasons are similar to those of British Guiana. The rainfall increases in amount as we go east. At Nickerie it is 66·70 inches; at Paramaribo, 99·85; at Montbyou, in the east of the Colony, it is 127·75 inches.

This Colony is apparently more unhealthy than British Guiana. I find it stated in the article on Paramaribo in Chambers's *Encyclopædia*, that "the deaths annually exceed the births. In 1874, there were 1548 births and 3364 deaths."

PATHOLOGY.—*Malaria.*—The prevailing diseases, according to Van Leent,[1] from which the acclimatised and the natives suffer, are frank intermittents; but new-comers are liable to irregular forms of fever, complicated with gastric and bilious symptoms. These are afterwards succeeded by true intermittents. The fevers, in general, are benign; but algid, choleraic, tetanic, and epileptic attacks occasionally occur. In children, the fever is often masked under the guise of trismus or convulsions. Remittents are pretty frequent. Of these the bilious remittent is the most common, and it is sometimes accompanied with numbness of the lower limbs, sleep, stupor, or hæmorrhages. The malarial cachexia is most frequently observed in those who reside on the plantations, near to marshes, or on the marshy banks of rivers.

Typhoid Fever is met with, but it does not seem to be very prevalent.

The *Chloro-anæmia*, known among the natives as "hati-wiri," is frequently seen; women are most subject to it. It is a grave affection, sometimes proving rapidily fatal by hydrops pericardii. Whether this disease is related to beriberi, is of malarial origin, or is due to some of the other conditions referred to as causing anæmia in British Guiana, cannot at present be determined.

Yellow Fever has never appeared in Surinam except when it has been introduced from without by shipping. It appeared in the

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[1] *Archiv. de méd. nav.* vols. xxxiii. and xxxiv.

Colony for the first time in 1836; then in 1851, when it made great ravages; its next outbreak was in 1854–57; and then in 1866, which, so far as I know, was the last outbreak of the disease. These are the epidemies mentioned by Van Leent, but it would appear from the researches of Hirsch that it was not unknown during the last century.

Surinam has only once been visited by *Cholera*, viz. in 1854 (11th July to 7th September). There were 68 attacks and 43 deaths. It was imported from Demerara.

Dysentery and *Diarrhœa* are of frequent occurrence; but although frequent, dysentery is here less severe than in the East India Islands.

Phthisis is probably as frequent in Surinam as in British Guiana.

Respiratory Diseases are not of frequent occurrence.

Congestion of the Liver is common, but abscess is rare.

Leprosy is met with in Surinam, but there are no data for estimating its prevalence.

Elephantiasis is said to have been introduced by slaves from Barbadoes in 1799. At the present day it is endemic in the Colony.

Frambœsia is endemic, affecting exclusively the coloured children.

Syphilis is by no means frequent, and is generally benign, except amongst the negroes in the forests, amongst whom it is more common and severe.

FRENCH GUIANA.

GEOGRAPHY.—French Guiana is situated to the east of Dutch Guiana, from which it is separated by the river Maroni. The river Oyapock divides it from Brazil on the south-east. A chain of mountains named Tumac-Humac, rising to between 3000 and 4000 feet, is its limit to the south. The Colony is watered by numerous rivers, some twenty of which are navigable. Lakes also exist. The rivers in their lower courses are sluggish, and subject to inundation, and many of them interlace so as to form a network. The coast line is low, and the soil alluvial, being covered with vast forests.

The Colony is divided into the two districts of Cayenne and Sinnamary, and these are subdivided into fourteen communes, most of which are situated along the coast. The chief town is Cayenne, with 5000 inhabitants, situated on an island at the mouth of the Cayenne River. The water supply of the town is good.

CLIMATOLOGY.—Dutroulau gives the temperature, humidity, and rainfall as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Temperature, C.,	27·8	27·0	26·3	26·6	27·3	27·7	27·8	28·5	28·7	28·6	28·4	28·0
Humidity, . .	91·3	93·9	94·1	92·9	91·9	90·7	88·4	82·5	87·6	88·7	90·5	91·5
Rainfall, mm., .	0·069	0·462	0·486	0·609	0·370	0·289	0·100	0·059	0·012	0·069	0·138	0·099

The chief characters of the climate here, as in British Guiana, are the high and equable temperature (the greatest range for the year being 4°·7 C.), the great humidity of the air, and the heavy rainfall.

PATHOLOGY.—*Malaria* is the predominating disease of Cayenne. Moursou (*Arch. de méd. nav.*) gives the proportion of cases of intermittent fever to total diseases as 68·1 per cent., and the deaths as 37·1 per cent. of total mortality. Cayenne is the most malarious of all the French Colonies, whether judged by the proportion of cases or by their fatality. The posts on the plain — St. George's, Sainte Marie, St. Augustin, and La Montagne d'Argent—are the most unhealthy. It is only when west winds blow from the land that the garrison at Cayenne is affected (Dutroulau). Moursou quotes from a paper by Dupont an account of an epidemy of intermittent fever arising under the influence of winds blowing from the land, and impregnated with malarial effluvia.[1] "Pernicious fevers," he says, "showed themselves in great numbers. The typhoid form declared itself as a very grave, and often mortal affection. Urticaria, herpes of the mouth, herpes zona, and generalised herpes in children were common, but these eruptions in no way relieved the fever."

The other islands along the coast of Cayenne, such as les Iles du Salut and Remire, are more healthy than the mainland. The mouth of the Maroni is less malarious than most other points on the coast. The experience of colonists and convicts goes to show that the white races cannot stand agricultural, or indeed any severe labour in this climate. In 1763, a body of 12,000 colonists, mostly from Alsace and Lorraine, settled in French Guiana. In three years, only 2000 of their number remained alive. Nor has recent experience been much more favourable. The transportation of convicts to Guiana began in 1851. The mortality from dysentery, malarial fever, and yellow fever (which was then epidemic) was very great. In the course of 1855 and 1856 the free colonists lost 886 out of 4254, and 358 were repatriated; and of 6915 convicts, 2528 died between the 11th of May 1852 and the 31st of December 1856. By abandoning the more unhealthy settlements an improvement has taken place in the health of the convicts, but the mortality amongst them is still great. Orgeas, in his interesting account of the colonisation of Guiana by transportation,[2] shows that the natural increase of the population is prevented by abortions and still births, the results of the malarial infection.

Remittent fever is rare in Guiana, showing itself usually in an epidemic form, in connection with the cutting down of forests, bad drainage, and the abandonment of cultivation. It appears to attack, by preference, the new-comers. Under the influence of atmospheric perturbations and peculiar meteorological phenomena, it may take on the typhoid character and render the diagnosis uncertain.[1] Out of 5047 admissions for malarial fever at Maroni, 30 cases only were of the remittent type.

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[1] *Archiv. de méd. nav.* xxix. pp. 108–111.

[2] *Ibid.* vol. xxxix.

Saint-Pair, quoted by Rey, remarks the rapidity with which, under certain conditions, the malarial cachexia is established. One month, he states, and in some cases a few days, will suffice to determine profound anæmia.

Typhoid Fever.—Dupont states that typhoid fever is observed in French Guiana at all seasons and affects all races. It is rarer than in Europe, and the chances of immunity (other things being equal) augment with the length of residence in the Colony. Under particular conditions of crowding or of contagion, it may present itself under the form of grave and fatal epidemies.

Yellow Fever, as we have already seen, appears from time to time in an epidemic form in this Colony. Hirsch records nine such outbreaks between the years 1763 and 1877.

Diphtheria is not unknown in Cayenne. *Croup,* if it occurs, is rare.

Dysentery, according to Moursou, accounts for only 12·2 per cent. of the admissions and 26·7 per cent. of the deaths in Cayenne; but it is said to be more common in the mountainous parts of the interior (Hirsch).

Phthisis is common on the plains, but is less so in the interior.

Pneumonia and *Bronchitis* are by no means rare among the coloured inhabitants.

Leprosy and *Yaws* are endemic among the coloured inhabitants.

Beriberi showed itself for the first time in Cayenne in 1865, among imported coolies, and reappeared again in 1877, among coolies introduced from neighbouring settlements (Hirsch). The disease is thus not endemic in Cayenne.

The *Anchylostomum duodenale* is as common in Cayenne as in British Guiana, affecting alike all classes and races (Riow Kérangal).

Chloro-anæmia is excessively common, often ending in anasarca and death.

Rheumatic Affections are of frequent occurrence; but as regards their fatality, as compared to that which they occasion in Europe, I have met with no precise statements.

Scrofula is seldom seen in the Colony.

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[1] *Archiv. de méd. nav.* vol. xxx.

CHAPTER VIII.

BRAZIL.

GEOGRAPHY.—Brazil extends between 4° 30′ N. lat. and 33° 45′ S. lat., and between 35° and 73° W. long. Its length is 2600 miles, and its greatest breadth about 2500 miles, with an estimated area of 3,288,000 square miles. The population is reckoned at 12,000,000, including 1,000,000 Indians.

Brazil is divided into twenty provinces. Those lying along the Atlantic, enumerating them from north to south, are the following :—1. Amazonas, which stretches into the interior to the head-waters of the Amazon; 2. Para; 3. Maranhao; 4. Piauhi; 5. Ceara; 6. Rio Grande do Norte; 7. Parahyba; 8. Pernambuco; 9. Alagoas; 10. Sergipe del Rey; 11. Bahia; 12. Espiritu-Santo; 13. Rio de Janeiro; 14. San Paulo; 15. Parana; 16. Sta Catherina; 17. Rio Grande do Sul. In the interior are—18. Matto Grosso; 19. Goyaz; 20. Minas Geraes.

Brazil, south of the Amazon, is traversed from north to south by several ranges of mountains, having a general direction from north to south. From this it follows that the principal rivers run either north or south, except those along the shore, which, rising in the eastern range, fall into the Atlantic. About 18° S. lat. is the water-parting; the rivers arising to the north of this line flow to the north, either to the ocean or the Amazon; to the south of this the direction is reversed, and the great rivers, the Paraguay, the Parana, and the Uruguay, direct their course to the south.

Many of the rivers, large and small, overflow during the rainy season, and to this cause Sigaud ascribes the unhealthiness of many localities. Among the rivers mentioned by this author, which, by their overflow, occasion malaria, the following may be mentioned: the Rio Doce, Rio de San Francisco, Rio das Mortes, the Parahyba, the Parana, the Amazon, and its Guapore tributary among others, also the Rio Madeira and the Rio Belmonte. He adds, that the small rivers cause the same disasters as the large ones in different provinces of the empire, and transform the localities through which they flow into foci of malarial infection.

As the first range of mountains run parallel with and near to the sea, the coast plains on the south are of very limited extent. To the north, the great plain of the Amazon stretches for more than 1800 miles from the foot of the Andes to the Atlantic, with an average breadth of 700 miles. The interior of the country to the south of the Amazon valley rises to a plateau, broken by hills, having a general elevation of 1000 to 3000 feet.

The chief towns are Rio de Janeiro, with a population of about 350,000; Bahia, 150,000; Pernambuco, 130,000, and Para, with 35,000 inhabitants.

CLIMATOLOGY.—The northern part of the country, corresponding to the Amazon valley, stretching from the equator to 9° S., has necessarily a tropical climate. The average mean temperature of Para, near to the mouth of the Amazon, is 27°·1 C.; that of February, 26°·0; and that of November, 27°·7. The climate of this region approaches to that of the coasts of Guiana, being hot, equable, and moist. At Pernambuco, in lat. 8° 4′ S., the mean temperature of the year is 25°·7; that of July, 23°·9; and that of February, 27°·1. The rainy season here begins at the end of December; in February a slight abatement takes place, but in March the rains again become heavier, and fall in abundance until August. The relatively dry season is from September to December. The number of rainy days at Pernambuco is 235.

The monthly mean temperature and rainfall of Rio, in lat. 22° 54′ S., for an average of seventeen years (Bourel-Roncière), is as follows:[1]—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature,	26·2	26·5	26·1	23·0	22·8	21·1	21·3	21·4	21·7	22·8	23·9	25·1 = 23·63
Rainfall, .	0·119	0·092	0·143	0·088	0·108	0·043	0·048	0·065	0·058	0·076	0·118	0·148 = 1·106

The climate of Rio is hot, with great and constant humidity of the atmosphere; mists are frequent, and the number of rainy days eighty-six.

At the island of Sta Catherina, in lat. 27° 25′ S., the monthly mean temperature is as follows:[2]—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26·04	26·25	25·57	23·46	20·34	19·0	16·61	17·93	19·23	21·54	22·76	24·96 = 22·01

Storms and rain begin here in July, and continue at intervals in the following months; but it often rains abundantly during the nights in the months of December and January.

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[1] *Archiv. de méd. nav.* vol. xvii.

[2] *Ibid.* vol. xxvii., 1877.

The rainfall varies greatly in amount and distribution in the different parts of the Republic.

The rainfall in the valley of the Amazon is very heavy, but it diminishes as we approach the south. The rains in the interior provinces of Goyaz and Matto Grosso are heavy, but there are also long periods of drought. At Ceara the rivers are dry from the month of June to the end of December. The Sertão country, which forms nearly a half of the province of Minas Geraes, extending from 13° to 21° S. lat., has two well-marked seasons, one of heavy rains and the other of great droughts, during which the pastures are burnt up, and the earth becomes fissured and cracked under the burning sun. The marshes which are disseminated over this region become injurious to health until they are again submerged by the rains.[1]

PATHOLOGY. — *Malaria.* — Malarious diseases prevail very generally over the length and breadth of Brazil, but affect different provinces, and particular localities in each province, very unequally.

The valley of the Amazon, so far as is at present known, is comparatively free from fevers of a severe type. The experience of Bates and other travellers shows that this river and its main tributaries can be traversed with infinitely less danger than the rivers of Africa. But it is a mistake to assume, as some have too hastily done, that malaria is absent from this region.[2] "Sizoens," or the ague of the country, is met with in many localities. When the forest has been cleared and the earth disturbed, the character of the climate will become better known.

Sigaud enumerates intermittent fevers among the diseases which have exercised the greatest ravages in the province of Para, bordering on the Amazon.

At Pernambuco, malarial fevers are moderately frequent—causing about 21 per 1000 of the total mortality.

At Bahia, still farther to the south, intermittent fever and dropsy, which is probably the result of the malarial poison, are very common.

The town of Belmonte, on the river of the same name, about 250 miles south of Bahia, situated on low ground and subject to inundation, is a prey to periodic fevers. The banks of the Rio Doce, between Belmonte and Rio de Janeiro, are liable to inundation, and the country is notably malarious.

The interior provinces of Goyaz, Matto Grosso, and Minas

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[1] Sigaud, *Du climat et des maladies du Brésil*, Paris 1844.

[2] Bates, *The Naturalist on the River Amazons*, London 1873, pp. 258, 261; see also Wallace, *Travels on the Amazon*, pp. 257, 270.

Geraes present many malarious *foci*. Remittent and intermittent fevers reign along the banks of the rivers, and have repeatedly become epidemic in periods of great drought, when the marshes left by inundations have partially or wholly dried up.

The climate of Rio de Janeiro is hot and humid. The greater part of the city is built on a level alluvial plain, the soil of which consists of clay and sand, subject to infiltration and stagnation of rain water, and to the percolation of water from the neighbouring hills, which also prevent the free circulation of the winds. In the environs of the city vast marshes exist, and the vegetation in the surrounding country is rank. It is not surprising, then, that Rio should be specially subject to malarious influences. The interior of the province is affected by malaria to a still larger extent than the city or its environs. Roncière states that in the marshy districts of the interior fever constitutes, so to speak, the exclusive cause of the diseases that affect the inhabitants, and the greater part of the fever patients in the Rio hospitals are drawn from these districts. Out of 22,478 patients admitted into the medical wards of Miséricorde Hospital,[1] during the five years 1861 to 1866, no fewer than 9756, or nearly one-half (43 per cent.), were suffering from malarial fever or malarial anæmia. The figures given by Bourel-Roncière [2] are as follows:—

Intermittent Fevers,	Quotidian,	6422	7698
	Tertian,	1239	
	Quartan,	37	
Pernicious Fever,			360
Malarial Anæmia,			1698
			9756

In addition to these fevers distinctly malarious, there were 930 admissions for gastric and bilious fever.

Roncière states that malarial fever at Rio often assumes the remittent or continued form. Pernicious fevers of all the usual forms are met with. The most feverish months at Rio are from December to April.

Nor are the provinces to the south of the capital, enjoying a temperate climate, free from the malarious influence; although they are, upon the whole, more healthy than those which we have been considering, except in certain localities where conditions specially favourable to endemic disease exist. Rey, speaking of the island of Sta Catherina, remarks that intermittent fevers are common, especially near the great lagoon, where almost all the inhabitants present the features of the malarial cachexia. Pernicious attacks, tetanic and choleraic, are observed here during the hot season, and he adds, that one often meets with cases of intermittent pneumonia.

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[1] The diseases included in the 22,478, in addition to these fevers, include bronchitis, phthisis, diarrhœa, smallpox, gastric and bilious fevers, entero-colitis, pneumonia, typhoid fever, and hepatitis.

[2] *Archiv. de méd. nav.* vol. xvii.

Having now very briefly noticed the distribution of endemic malaria, we shall refer to the important subject of epidemic malarial fever, which occupies an important place in the medical history of the Republic.

Numerous epidemies of malarial fever are recorded by Sigaud; but the nature of the disease, in some of the earlier instances, is doubtful, especially in those epidemies that are ascribed to famine.

Those outbreaks, the malarial character of which is most evident, are almost always ascribed either to great drought or to inundation of the rivers. A remarkable epidemy broke out at Macacu, in the province of Rio de Janeiro, in 1829, a district rich in virgin forests and plantations of coffee, sugar, and rice. It was ascribed to the great droughts of 1829 and 1830, following upon heavy rains, which had transformed the country into a vast marsh, and to the denudation of marshy lands for purposes of cultivation. The temperature about the time of the outbreak, that is, in the end of December 1829, was excessively variable, sometimes falling in the space of sixty hours from 90° to 71° F. In January 1830, the temperature was excessive, varying from 90° to 96° F., according to locality.

The epidemy spread along the littoral, extending north to Espiritu-Santo and south to Santos, a distance of some 400 to 500 miles. The fever was of the intermittent and remittent forms. It often began as an intermittent, and then became suddenly transformed into a remittent or continued fever; the tertian type also often changed into the quotidian.

It was observed that, in those who survived the remittent attack, the recovery was perfect, and that relapses were not to be feared; whereas the contrary was the case when the fever was intermittent.

In the remittent form, a change usually took place about the period of the fourth or fifth exacerbation. The remission now became more marked, but was succeeded by copious cold sweats—often fatal. Somnolence, coma, and pallor of the face were frequent symptoms. Many of those who were not affected by fever suffered from primary malarial cachexia, a form of the malarial infection which has received less attention than it deserves. The epidemy appears to have attained its height from January to April 1830.

An epizooty prevailed about the same time, but nothing is known of its nature.

A series of more localised epidemics followed in 1830 and 1831 at Iguaxssú and Irajá, and in 1833, 1834, and 1835 at Pilar and Marapicú; these were probably only recrudescences or extensions of that to which we have just referred. Fever was again epidemic in 1852 and 1859, but to a less extent. Roncière noticed that the workmen engaged on the Pedro railway filled the hospitals, and gave rise to the greatest proportion of deaths. After the railway was finished, the adjacent localities again became more healthy.

Typhoid Fever probably exists in all parts of Brazil, but our information respecting its occurrence is limited to Rio. The fact that Sigaud believes that it was imported in 1836 by a vessel from the Canaries, may be taken as evidence that it was much less prevalent before that date than it has since become. During the five years 1861 to 1866, typhoid fever was the cause of 479 admissions into the Miséricorde Hospital, or about 2·1 per cent. of the total diseases mentioned above. But since that time it has become more prevalent in Rio. According to Dr. Torres Homem, it has been much more frequently met with since the epidemic outbreak of yellow fever in the year 1873, although in what way this could affect the prevalence of typhoid fever it is difficult to imagine.

The disease, as seen in Rio, presents in many instances the same symptoms which it displays in Europe; but it more frequently differs in some particulars from the type which we are wont to regard as characteristic of the malady. The following are some of the chief peculiarities of the disease as observed in Rio:—

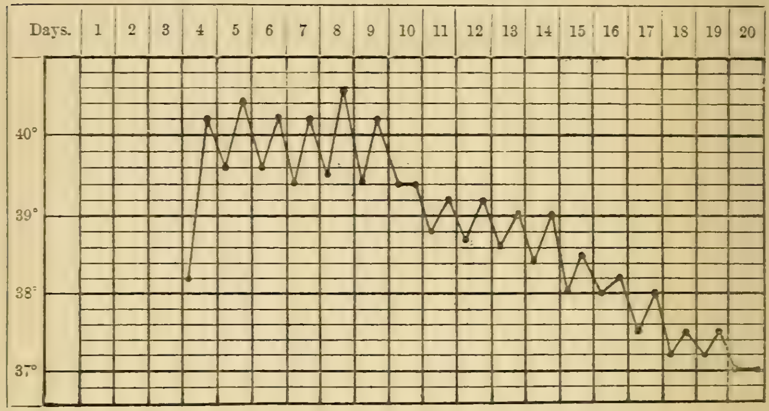
(1) The disease often begins as a true intermittent of the quotidian type, but is refractory to quinine. (2) In many instances it begins as a sub-continued malarial fever, and it is only after the fifth or sixth day that the evening delirium and other symptoms appear, clearing up the diagnosis. (3) As a general rule, in the grave cases of typhoid, the march of the temperature is very irregular, the zigzag line of the first period being often wanting. (4) Epistaxis is rare, except in children. (5) Diarrhœa is often absent; indeed, constipation is the rule during the first week. (6) The rose spots are only met with in exceptional cases. (7) Congestion of the liver is frequent; that of the spleen less pronounced, and is sometimes wanting. (8) Intestinal hæmorrhage is rare. (9) Bilious complications, with intense jaundice, not

arising from catarrh of the bile ducts, are very common. This disease can, in some cases, be only distinguished with difficulty from the remittent type of malarial fever of the typhoid form.

Typhoid fever is most fatal during the months of March, April, May, and June.

We give the following chart after Torres Homem to show the temperature curve of some cases of typhoid at Rio:—

TYPHOID FEVER. (Torres Homem.)



Typhus Fever has been observed in Brazil, but it is not endemic in the country.

Yellow Fever. — This disease made its first appearance in Brazil in 1849, and since that date the country has seldom been free from it for any length of time. Contrary to what has been observed elsewhere, the natives of Southern Europe have suffered in greater proportion from yellow fever than those from the north.

Diphtheria was almost unknown at Rio before the year 1860. Since that time it has become endemic, but it does not appear to rank as one of the fatal diseases of the country. *Croup* causes only a small mortality.

INFLUENZA.

Influenza, in its pandemic extensions, visits Brazil as it does other parts of the world. The principal epidemics affecting Brazil, of which we have a record, are those of 1780, 1801, 1816, 1834, 1855, and finally that of 1890. Another form of the disease which we have met with in various parts of the world is also observed in Brazil. Bates[1] says that the principal cause of the diminution of the Jurís and Passés—tribes inhabiting the country near Ega—"seems to be a disease which always appears amongst them when a village is visited by people from the civilised settlements." It is called "defluxo" by the Brazilians, and seems to be of the nature of influenza. The visitors who bring the disease are often free from it themselves; "the simple contact of civilised men, in some mysterious way, being sufficient to create it. It is generally fatal to the Jurís and Passés: the first question the poor, patient Indian now puts to an advancing canoe is—Do you bring defluxo?"

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[1] Bates, *The Naturalist on the River Amazons*, 3rd ed., Lond. 1873, p. 256.

It may not be out of place here to sum up the results of our observations of the various forms of influenza which have been described in the preceding chapters, with special reference to the recent epidemy of 1889–90.

The forms of influenza which have come under our notice may be classified as follows:—

1. *General Influenza,*—a disease remarkable for the rapidity and extent of its diffusion. Two varieties of this form have to be distinguished: (*a*) That which, beginning at one or more definite centres, spreads *de proche en proche* in all directions along the principal lines of communication, and frequently extends over the greater part of the globe, so as to be justly regarded as *pandemic* in its extension. (*b*) That which, beginning simultaneously at numerous and widely-separated centres, diffuses itself over areas co-extensive with one or more countries, but which is seldom carried to great distances, or transported across oceans, so as to become pandemic in its diffusion. This latter variety we shall speak of as *epidemic* influenza, although all forms of the disease are essentially epidemic in their manifestation.

2. *Local Influenza,*—characterised by its frequent occurrence within comparatively limited areas, at certain seasons of the year.

3. *Strangers' Influenza,*—such as that which we have just described as affecting certain of the Indian tribes of Brazil—a disease mysteriously introduced into secluded communities by strangers who are themselves free from the disease, and who do not come from countries where influenza is, at the time, epidemic.

4. *Endemic Influenza,*—a disease which probably exists in many regions, and which, under unknown conditions, may assume an epidemic form.

(1.) In studying general influenza, we have to consider: (*a*) the origin or starting-point of epidemies; (*b*) their extent; (*c*) the direction in which they spread; (*d*) their rate of march; (*e*) their duration; (*f*) the epidemic features of influenza; (*g*) its mode of propagation from one region to another, and within a given locality; (*h*) the relation of influenza to season and weather.

(*a*) *The Origin or Starting-point of Pandemic and Epidemic Influenza.*—Does influenza always arise in a certain region or regions, or does it arise indifferently in any part of the world? This is the question to which we seek an answer. Many epidemies are so imperfectly defined, that it is impossible to decide when or where they began. Thus, if we attempt to trace the starting-point of that outbreak which Hirsch recognises as the pandemy of 1847–48, we find that the disease had, in fact, been occurring in scattered outbreaks all over Europe from 1841 down to 1847, so that we are baffled in our attempts to assign any date within that period, or any point of origin within the limits of Europe, that would not be quite arbitrary. We have, therefore, to restrict our attention to those epidemies which have arisen after the disease has been absent from the world, or from a continent, for such an interval, as to make it probable that we are dealing with a new outbreak.

The following table, constructed from Hirsch's Chronological Survey, gives the date and place of the appearance of certain epidemies that have broken out anew after the disease had been absent for several years:—

EUROPE.

Date of Last Appearance.	Country in which it was last observed.	Interval of Absence in years.	Date of Reappearance.	Place in which it was first observed.
December 1712	Italy	17	April 1729	Moscow
December 1767	Spain	8	March 1725	Germany (Clausthal)
August 1782	Spain	6	March 1788	St. Petersburg, Kherson, Poland
October 1788	Geneva	12	October 1810	Moscow
January 1808	England	19	January 1827	Siberia (Tobolsk, Tomsk)
February 1827	Russia	3	November 1830	Moscow
November 1833	Italy	3	December 1836	Russia, Sweden, Denmark, Germany, England
July 1837	Faröe Island	4	January 1841	Germany
March 1851	Italy	3	May 1854	Bavaria
...	...	...	May 1890	N.-W. Territories of Canada, Greenland, Bokhara
AMERICA.				
October 1807	Western States	8	September 1815	Boston
February 1816	S. Carolina	8	October 1824	Boston
September 1858	Vancouver's Island	3	December 1861	Philadelphia
January 1862	Bermudas	11	January 1873	Philadelphia

It will be seen from the above table, that general influenza is not limited, as respects origin, to any special locality or region. So far as our record goes, it may break out in Central Asia, in Siberia, in Northern and Central Europe, in Greenland; in the North-West Territories of Canada, or in New England. It may appear simultaneously in regions as widely apart as Athabasca and Bokhara, as was the case in 1889. In this instance, there can be no question of its having been introduced from the one place to the other by human intercourse, or into both, in the same way, from a common centre of infection. Here we must assume the existence of some unknown conditions, so wide in their range as to include Athabasca, Greenland, and Bokhara, within the sphere of their operation, determining the outbreak of the epidemy, at the same time, in these regions.

When influenza originates in the United States, it appears usually to break out on the seaboard of New England. On the occasions when it has been observed to spread from south to north, as in 1761 and in 1789, there is reason to believe that the disease was introduced from Europe.

May not its appearance in New England, when not of European origin, be owing to its introduction by whalers, or other vessels from Greenland or the far North, where it has probably been frequently epidemic at periods of which we have no record?

Three points deserve notice: (1) While the more restricted outbreaks of the disease have not unfrequently appeared in Central or Western Europe, as in Germany in 1775, 1804, 1841, and 1854, and in France in 1780; yet the great pandemies, such as those of 1732–33, 1781–82, 1788–90, 1830–33, and 1889–90 have had their epidemic starting-point in the north of Europe or of Asia; and, as we have said, the extreme north of America may be the cradle of those epidemies that have from time to time originated in and overrun the western hemisphere. (2) Those outbreaks that have originated in Central and Western Europe have been more limited in their spread, and have never become pandemic. (3) Certain epidemies, as those of 1836, 1855, 1857, and, perhaps, we might add those of 1841 and 1780, do not appear to have been propagated from any single centre, but to have declared themselves simultaneously at different places, far apart. Thus, Hirsch gives the month of December 1836, as the date of its appearance in St. Petersburg, Sweden, Denmark, Germany, and England; and the month of December 1855, as the date when it was again observed in Russia, Germany, Holland, Belgium, and Italy.

In investigating the etiology of influenza, instances of this kind, in which the disease has not spread from a single centre by contagion, but has arisen at various centres, independent of communication, deserve special attention.

(*b*) *The Extent of Epidemies.*—The pandemy of 1889–90, respecting which we have the fullest information,[1] first appeared in Bokhara, and successively invaded Tomsk and St. Petersburg, which may be looked upon as the epidemic starting-point, from which it spread over the greater part of Europe, Asia, Africa, America, and Australia. Yet wide-spread as this epidemy undoubtedly was, certain countries escaped untouched. Leaving out of account that part of South America corresponding to Venezuela and Guiana, respecting which our information is at present defective, the epidemy did not extend to New Guinea, Seychelles, the Falkland Islands, the Bahamas, Grenada, St. Lucia, British Honduras, or Fiji, and it appears probable also that many of the islands of the East Indian Archipelago and Polynesia escaped the infection. Some islands, such as Ceylon and Madagascar, which do not appear to have been reached by former outbreaks, have been visited by the epidemy of 1889–90.

It will be observed that the places that have escaped are comparatively isolated, and not in frequent and direct communication with the rest of the world, and it is to this isolation from infected centres that their immunity is to be ascribed. For the same reason, it was observed that no case of the disease appeared among the crews of the 51 light-ships in the British seas. The keepers of the 16 lighthouses, situated on detached rocks, who with their families numbered 415, likewise escaped the infection, except in such instances as were clearly traceable to contagion; and no instance is reported of the appearance of influenza amongst the seamen employed in the deep-sea fisheries, in ships of war, or in merchant vessels, except when communication with infected persons or places is known to have taken place.

All this furnishes a powerful argument in favour of the view that, in its pandemic form, influenza is propagated by contagion and not by some general distemper of the air.

Some countries suffered more extensively and severely in 1889–90 than others. In Berlin, Vienna, Belgrade, Antwerp, and in Massachusetts the proportion of the inhabitants attacked was estimated at from 30 to 40 per cent.; at St. Petersburg, Heligoland, Buda Pesth, and Pekin, at about 50 per cent. In one district in Ceylon the numbers affected were put down at 89 per cent., and in Portugal at 90 per cent.

[1] Parson's *Report on the Influenza Epidemic* of 1889–90, Lond. 1891.

In certain large establishments in England, the proportion attacked varied from 8·4 to 33 per cent.

Nor is its diffusion over a country during its pandemic extensions at all uniform. Some districts in England (chiefly isolated ones), escaped the disease altogether, others suffered in a minor degree. Of twenty-eight of the large towns of England and Wales, two, viz. Blackburn and Huddersfield, escaped in 1889–90, and Derby was only slightly affected. The complete or partial immunity enjoyed by these towns can certainly not be accounted for by the absence of intercourse with infected centres. Of 167 military stations in the United Kingdom, 45, with an aggregate average strength of 14,102, had remained free from influenza up to May 9th, 1890.

(*c*) *Direction of Spread.*—During its pandemic extensions, and the same probably holds good of its more limited outbreaks, influenza becomes diffused in all directions from the centre at which it originates, and from the new centres of infection afterwards established. The general direction of the late pandemy has been from east to west and from north to south in the northern hemisphere, and from south to north in the southern hemisphere, but numerous exceptions to this rule occurred; and it may be safely said that the general direction of its spread was determined by the lines of communication with infected localities.

(*d*) *The Rate at which Pandemies spread.*—Do pandemies of influenza spread faster than men can travel, and has the time required for their spread diminished in proportion to the increasing rapidity of communication? These questions have an important bearing upon the mode in which influenza is propagated. We must here, again, distinguish between epidemies arising simultaneously at various points and pandemies arising from a given centre, to which latter variety alone our remarks as to the rate of march are applicable.

The following table gives the period in months (or weeks) that elapsed between the first appearance of a pandemy at Moscow or St. Petersburg, and its subsequent outbreak in Germany, France, England, and America. When both Moscow and St. Petersburg are named, the number of months or weeks are reckoned from its epidemic appearance in the latter. Those pandemies are selected which appear to have run their course independent of one another:

1729–30.

Moscow (April, 1729).

Germany,	6 months.
France,	11 ,,
England,	7 ,,
New England States,	43 ,,

1781–82.

St. Petersburg (January 1782).

East Prussia,	1 month.
France,	5 months.
England,	3 ,,

1788.

St. Petersburg (March, 1788).

Germany,	1 month.
France,	5 months.
England,	3 ,,
America,	19 ,,

1799–1800.

Moscow (October, 1799).
St. Petersburg (December, 1799).

Germany,	2 months.
France,	10 ,,
England,	24 ,,

1830–32.

Moscow (November, 1830).
St. Petersburg (January, 1831).

Germany,	3 months.
France,	5 ,,
England,	5 ,,
America,	10 ,,

1889–90.

St. Petersburg (October 15th, 1889).

Germany (Berlin),	8 weeks.
France (Paris),	9 ,,
England (London),	10 ,,
America (New York),	10 ,,

Although the dates of some of the outbreaks of influenza in different countries cannot be very exactly ascertained, especially for the last century, the periods given above may be accepted as approximately correct. None of these pandemies have travelled faster than the means of communication at the time permitted; and their rate of progress has increased during the last two centuries, with the increasing rapidity of communication. The increasing rapidity of spread is not, however, uniform. Accidental circumstances appear to have delayed the progress of the epidemy on some occasions. During the last century, influenza generally reached England earlier than France,—a circumstance which was probably owing to the communication by sea at that time being quicker than by land. It will be remarked also that the disease on the last occasion (1889–90) broke out in New York as early as in London. This is perfectly consistent with the view that the disease is carried from place to place by infected persons or things, but is opposed to the theory of the progress of an epidemic wave passing from east to west.

It is important also to note, that the last epidemy has not travelled by any means so fast across Europe as the means of communication permit. The approximate time occupied in course of post from St. Petersburg to London at the present day is seventy hours. Influenza could thus have been introduced by infected persons and things from St. Petersburg into London as easily within a week or a fortnight as in the ten weeks which actually elapsed between the appearance of the epidemy in the two places. If we have to deal simply with contagion carried by persons, letters, or parcels, it will be difficult to account for the length of time that elapsed before the outbreak of the epidemy in London. This delay seems to indicate that the infection has not only to be transported into a new locality, but that a period of latency exists, during which it multiplies, and perhaps undergoes development, before an epidemy is established.

(*c*) *Duration of Epidemies.*—The period which influenza takes in running its pandemic course depends upon the rapidity of communication at different epochs. The duration of an epidemy, on the other hand, in a given locality is much the same now as formerly. Its course is short—seldom lasting for more than three or four weeks In London, the epidemy proper may be said to have extended from the 30th of December 1889 to the 20th of January 1890, although scattered cases were observed before and after these dates. A considerable number of cases, indeed, occurred up to May; but as an epidemy it can scarcely be said to have exceeded the limits we have mentioned.

The course of the outbreak in London may be traced from the number of new cases of the disease treated weekly in certain of the London hospitals, as exhibited in the following table, which includes the period from December 23, 1889, to February 2, 1890:—

	Number of New Cases treated.
Week ending 29th December 1889, ...	19
,, 5th January 1890, ...	562
,, 12th ,, ,, ...	2009
,, 19th ,, ,, ...	1307
,, 26th ,, ,, ...	505
,, 2nd February ,, ...	259

The epidemy, as judged by the number of new cases treated, reached its highest point on the 8th of January, that is, ten days from its outbreak.

In the army the period between the first and last case at the larger stations varied from six to fourteen weeks, but as an epidemy it was of much shorter duration, probably not exceeding three weeks.

In the navy, when the ship's company did not exceed 150 men, the disease in many instances ran its entire course in twelve days; when the men numbered from 500 to 800, it lasted, on an average, about a month; but this again is reckoning, not the epidemic period, but the whole time between the first and last case. In the *Archer*, with an average daily force of 184 men, the first case, we are told, occurred on the 17th of February; the maximum number was attained on the 23rd, that is seven days from the appearance of the first case; the last case occurred on the 10th of March. It thus appears, that when influenza breaks out amongst a small body of men in a ship, where the whole community is in constant contact or in close proximity, the epidemy only requires three or four days less to reach its height than in a great city like London.

(*f*) *Characters of an Epidemy.*—An epidemy of influenza is thus marked by a period of latency, by its rapid development, and its speedy decline. No purely contagious disease, such as smallpox, measles, or scarlet fever, presents the same epidemic features. None of these spread over an entire continent, or even over a single country, within a period of two months. They occur rather as limited outbreaks in different localities; they never extend over the whole of a country as large as the United Kingdom within a short time. The incubation period of influenza is short. One attack does not secure an absolute immunity from another. Dr. Parsons says that "one attack of influenza does not seem to be protective against another." Certainly cases are numerous in which those who have suffered during one epidemy have been attacked again during a succeeding one; and instances have also been observed of two attacks having occurred during the course of a single outbreak. But the same is the case in respect to measles and smallpox,—and it cannot be claimed for influenza that one attack confers the same degree of immunity as that which follows an attack of one of the purely contagious diseases. Yet I venture to think that, as a rule, one attack of influenza is to some extent protective. It is rare to see all the members of a household down with influenza twice, either in the same or in successive epidemies.

(*g*) *Mode of Propagation.*—That pandemic influenza is transportable from one country to another and from one locality to another by persons suffering from the disease, or by infected articles, such as letters, clothing, etc., appears to me to be proved by the following facts relating to its spread:—

1. The manner in which it spreads along lines of communication and the time which it takes to pass from place to place.

2. The numerous observed instances in which influenza has appeared in a locality after the arrival of a person suffering from the disease, who had himself contracted it after having been in contact with persons suffering from the malady.

3. Instances in which the outbreak of influenza in a family has followed intercourse with neighbours suffering from the disease, the person who had communication with a previous case being the first affected.

4. The immunity enjoyed by persons cut off from intercourse with infected centres, such as the inhabitants of remote islands, lighthouse keepers, and deep-sea fishermen.

When once introduced into a locality it is less certain that its spread is effected solely by contagion. Influenza does not as a rule break out immediately after the importation of the infection; nor does the disease increase steadily and progressively, in the way in which it might be expected to do, if it were propagated in a locality by contagion only. On the contrary, after a period of latency—in which a few scattered cases occur, testifying to the presence of the infection in a community—its epidemic outburst is sudden, and within a few days the majority of susceptible persons are attacked.

Making every allowance for the immense intercourse between the members of a city community in offices, conveyances, markets, theatres, churches, and schools, it is doubtful whether its diffusion by contagion—by which I mean both actual contact with and close proximity to infected persons—would sufficiently account for its extraordinary rapidity of spread.

Nor is it easily explicable, on the theory of simple contagion, that an influenza epidemy takes approximately the same time in attaining its maximum in a city like London, and in a ship, where all the men are in constant and close proximity to each other.

Granting that the germ of the disease is transported from one place to another, it by no means follows that its spread in a locality is effected solely by contagion. Once introduced, it is not improbable that the infection multiplies, and perhaps undergoes some kind of development in the surroundings, and becomes diffused within a limited area as an air-borne miasm. Influenza may thus be looked upon as a miasmatic contagious disease.

Upon this hypothesis, the exemption of some cities in daily communication with infected centres, and the varying prevalence and intensity of the disease in different localities, become intelligible, the conditions necessary to its development and multiplication being unfavourable or wanting in certain localities.

The objections which have been urged against the view, that pandemic influenza is propagated from place to place by infected persons or things, are based partly on the non-recognition of the pandemic as distinct from the epidemic variety of the disease, partly on defective data, and partly, perhaps, on our not allowing sufficiently for the persistence of the infection.

The principal objections of this kind are:—

1. That the disease invades, or has been supposed to invade, extensive regions, so suddenly, that it could not have been diffused either by infected persons or things.

2. Its alleged appearance in vessels that have had no communication with infected centres.

As an example of the first class of objections, we may instance the statement of Jones that influenza is capable of affecting "a whole region in the space of a week, nay a whole continent as large as North America, together with the West Indies, in the course of a few weeks, while the inhabitants could not within so short a time have had any communication or intercourse whatever, across such a vast extent of country." There has no doubt been a tendency to exaggerate the rapidity with which some outbreaks have become diffused over large areas, and such general statements, unsupported by dates, must be received with caution. But are we justified in assuming that influenza always spreads in the same manner, and that what is true of pandemic influenza applies to all forms of the disease? We have already shown that, if we are to accept the dates given by Hirsch for the appearance of influenza in Europe in 1836, 1855, and 1857, we must admit the existence of a variety of the disease appearing simultaneously over extensive areas; and we are not entitled to reject such evidence in order to support a theory. But, on the other hand, the existence of a form of the disease breaking out suddenly and simultaneously over a whole region, need not blind us to the patent fact that the pandemic form of the disease is propagated by the transmission of the contagium from place to place. A probable explanation of the simultaneous appearance of the disease over a large region will be given in the sequel.

The instances in which influenza is said to have appeared in ships at sea, cruising off an infected coast, without any communication having taken place with the land, are all open to suspicion—the dates are defective. In some of the alleged instances of this kind, there are good reasons for believing that the infection was introduced on board directly or indirectly from the shore; in all, the circumstances render it not improbable that communication with the land did actually take place.

But there is another class of cases, not so easily disposed of, in which the disease has appeared in an epidemic form in vessels while in port or while cruising off a coast, "no trace of the disease having shown itself, either before or after, in the same region ashore." For example, influenza broke out, in August 1856, in an English ship-of-war while in the harbour of Rio, where the disease did not then exist; and in the same way an epidemy occurred on board the French frigate *Chaumezière*, in 1863, "four days after leaving the harbour of Gorée, not a trace of the disease had shown itself in the town; while another ship-of-war that left Gorée two days earlier, and took the same course, arrived in the harbour of Brest, without having had a single case of influenza on board." In the year 1856, when the disease occurred on board the English ship in Rio, we have no knowledge of the disease having existed in any part of the world, excepting in Iceland and the Faröe Islands. But in June of the preceding year (1855) influenza had been prevalent in Rio. Although an immunity had been established for the inhabitants of the town, may we not suppose that the infection had not been entirely extinguished by the lapse of a year? This appears much more probable than that the outbreak was caused by some altered state of the atmosphere surrounding this particular vessel, in the harbour of Rio, and restricted to it,—not extending either to the atmosphere of the town itself, or to that surrounding the other vessels in the harbour. We have only to suppose that the contagium may remain latent in a locality for some time after an epidemy has disappeared—an assumption which will also satisfactorily explain the frequently observed recrudescences of the disease in localities, a year or more after an epidemy has subsided, and when there have been no grounds for suspecting a reintroduction of the infection. In this way, too, we may explain the epidemy on board the *Chaumezière.* In the year 1863, when this outbreak took place, influenza was epidemic in France, which is in frequent and rapid communication with Gorée. To me, the most likely explanation of the outbreak is that the infection was brought in some articles of clothing, or in the ship's stores, from France, and that the infected articles having been opened and exposed at the time the epidemy occurred, gave rise to the disease. The contagium of influenza probably retains its vitality for a considerable time under certain circumstances, and if this be admitted, all of those obscure outbreaks at sea may be readily explained without having recourse to any of the unreasonable explanations that have been advanced.

(*h*) *Relation of Influenza to Season and Weather.*—Hirsch found that of 125 epidemies or pandemies of influenza, which ran their course independent of one another, 50 began in winter (December–February); 35 in spring (March–May); 16 in summer (June–August); and 24 in autumn (September–November). Influenza thus appears to originate most frequently in winter or spring; but, having once started on its epidemic course, it is little, or not at all, affected by climate or weather. Thus, in the last outbreak, as Parsons has pointed out, influenza prevailed at the same time in the northern and southern hemispheres.

No country, from the Arctic Circle to the Equator, is exempt from influenza, but I am inclined to think that all regions do not suffer alike. In India, for example, it appears to be of less frequent occurrence than in the north and centre of Europe, and it is, at least, deserving of further investigation, whether the disease is not milder in the tropics than in high latitudes.

Local Influenza.—Apart from the almost annual occurrence of epidemic catarrh in high latitudes, we meet with accounts of influenzoid diseases in various temperate regions. Thus, in Madeira, as we have seen, influenza often prevails to a considerable extent at certain seasons of the year. We have also recorded the frequent occurrence in Fiji of a form of influenza, called by Corney, "epidemic naso-pharyngeal catarrh," appearing successively at stations from windward to leeward, and propagated, as he supposes, by the agency of the trade winds. The time, however, which elapses between the appearance of the disease in different localities is sufficient to admit of intercourse by ships, and consequently of its propagation by infection—and it will, I venture to predict, be found that the disease is carried by ships and not by the wind. I am not sure that this form of influenza should not be classed with that which we shall presently consider, rather than with local influenzas. A disease resembling influenza is frequently observed in New South Wales, in November and December, which is the sheep shearing season. Those employed in the sheep shearing sheds seem to be the first to suffer, but it soon spreads to the rest of the population. A similar complaint, known as "fog fever," is observed from time to time, in Victoria, where it was unusually prevalent in 1885. The local forms of the disease, although clinically similar to epidemic influenza, are distinguished by their appearance at certain seasons only; by their frequent recurrence, and by the fact that they do not become the starting point of wider outbreaks.

Strangers' Influenza.—The principal peculiarity of this form is that it attacks isolated communities, such as the inhabitants of remote islands, on the arrival of a foreign ship, or breaks out amongst secluded tribes, such as the Jurís and Passés of Brazil, on the appearance amongst them of a stranger from the settled districts. We have already noticed the occurrence of this disease in Iceland, the Faröe Islands, St. Kilda, in Samoa, and in the Society Islands. Another example of the same kind is supplied by Parsons, on the authority of a writer in the *British Medical Journal* for September 1886,[1] who states that an affection called *murri-murri*, indistinguishable in its main features from "an influenzoid cold," occurs in the Island of Wharekauei, situated 480 miles east of New Zealand, affecting the inhabitants, European as well as Maories, on the arrival of a vessel. The mere appearance of murri-murri is a proof to the inhabitants, even at distant parts of the island, which is 30 miles long, that a ship is in port; so that, on no other evidence, people have ridden to Waitaingi, the port, to fetch their letters."

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[1] Parsons, *Op. cit.* p. 84.

Ellis[1] informs us that in 1820, an epidemy of this nature, which proved fatal to many, appeared on one of the Society Islands on the arrival of a foreign ship; that it was carried from Tahiti to Huahine by a canoe, and that the disease "ultimately spread as completely through this group as it had through that at which the foreign vessel touched." The disease, in this instance, was thus clearly spread by contagion. In the year 1820, when this sickness was introduced into the Society Islands, influenza had, so far as is known, been entirely absent in its epidemic form from the world for four years. If the imported disease was influenza, the germ of it must have been present in the country from which the strangers came. We must thus conclude that some sickness, capable of giving rise to an epidemic and contagious influenzoid disease, is endemic in many countries, and that when the infection is introduced into a community, amongst whom it is absent, it is capable of assuming the epidemic form.[2]

Endemic Influenza.—A considerable number of deaths are registered every year from "influenza" in England and Wales, and it appears that the most of these are medically certified. Many at least of these deaths would appear to be caused by bronchitis, and not by true influenza, for the season of the year at which this kind of influenza occurs coincides with that in which bronchitis is most prevalent, and the age distribution of deaths from "influenza" in non-epidemic years is similar to that of bronchitis, and differs from that of epidemic influenza.

The quarterly distribution of 249 deaths registered from "influenza," during the twenty years ending 1889, was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
113	48	21	67

The first and fourth quarters are those during which "influenza" is most fatal; these are also the seasons when bronchitis makes most victims.

The following table, taken from Parsons' Report, shows the age distribution of 100 deaths from influenza in London during the non-epidemic period, 1876–89, and during the epidemic period comprising the first quarter of 1890:—

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[1] Ellis' *Polynesian Researches*, Lond. 1853, vol. iii. pp. 35, 36.

[2] Darwin mentions that "it is stated in Shropshire, that sheep which have been imported from vessels, although themselves in a healthy condition, if placed in the same flock with others, frequently produce sickness in the flock."—*Naturalists' Voyage*, Lond. 1889, pp. 435, 436.

Period.	Percentage at Several Ages.							
	Under 1	1–5	5–20	20–40	40–60	60–80	Above 80	Total.
1876–89, . .	32·8	16·0	3·4	3·4	10·0	26·9	7·5	100
First Quarter, 1890, .	5·2	4·3	4·7	24·7	36·2	22·4	2·5	100

The ages most subject to fatal attacks of the influenza of non-epidemic years are those under one, and between sixty to eighty, which are also the periods of life at which bronchial catarrh is most fatal. Epidemic influenza, on the other hand, as it appeared in England during the last epidemy, was most fatal at the ages from twenty to sixty. Yet these arguments, while they have their weight, are not absolutely conclusive that the influenza of ordinary years is different in nature from epidemic influenza; for the age distribution of epidemic influenza varies in different outbreaks; and, besides, influenza often proves fatal by inducing bronchitis, and if the age distribution of the excess of deaths registered in the first quarter of 1890, from lung affection, but really due to influenza, could be ascertained, it would show a very different age distribution than that of the cases that proved fatal without the intervention of acute bronchitis. Whatever may be the real nature of the cases registered as influenza in non-epidemic years, I think it highly probable that influenza is endemic in these islands.

In certain seasons catarrhs are so prevalent as to be truly epidemic, especially in severe weather; but it is doubtful if these outbreaks are specific in their character. But catarrh is often epidemic in certain localities even in mild weather,—running through all the members of a household in succession, and occasionally affecting even the domestic animals—especially cats and dogs. This latter form of epidemic catarrh is often accompanied by severe nervous depression, and differs in no respect from a mild attack of the epidemic malady. It is this form of disease to which I give the not very appropriate name of endemic influenza;—for, like all forms of the disease, this also exhibits epidemic characters.

This form of influenza is probably endemic in every country in Europe, and in every settled district of America. Few escape the disease altogether, and many doubtless suffer from it more than once in a lifetime.

May it not be possible that the immunity which so large a proportion of the population enjoys during an epidemic, is owing to the protective effect of one or more attacks of endemic influenza.

If we admit the constant presence in our midst of the germs of influenza, we shall have the less difficulty in understanding the sudden and simultaneous outbreak over the half of Europe of what we have spoken of as the epidemic, as distinguished from the pandemic, form of the disease. The germ is already there, and under certain conditions—probably meteorological—but of which we actually know nothing, the endemic malady assumes the epidemic form; but, even so,—its power of spread is limited compared to that of the pandemic form.

The facts which we have thus briefly stated lead us to the following conclusions:—

1. Influenza is endemic in Britain and in many parts of the world, showing itself, from time to time, in mild epidemies.

2. When the contagium of the endemic disease is introduced into a locality where the disease is not endemic, it gives rise to the contagious and epidemic malady known as "strangers' influenza."

3. Under certain unknown conditions the endemic malady assumes an epidemic form simultaneously over large areas.

4. A more intense form of the disease appears at intervals, which, starting from a centre, spreads over the greater part of the world, being propagated by the transference of the contagium from place to place by infected persons or things. When once introduced into a locality, the contagium develops and multiplies after the manner of a miasmatic contagious disease, and is diffused, within comparatively narrow limits, by the agency of the atmosphere.

5. The conditions favouring the development of the infection are not always nor equally present in all localities, so that certain places, into which the contagion is introduced, escape during its epidemic prevalence, some suffer slightly, others severely.

6. The contagium may retain its infective power for longer periods than has generally been supposed to be the case, and this explains its outbreak on board vessels, when at sea or in harbour, when the disease is not present ashore or in the port from which the vessel has sailed.

7. The relation of the local forms of the disease to the epidemic malady requires further investigation.

Cholera visited Brazil for the first time in 1855, appearing at Para in the middle of May, and at Bahia in June. It afterwards reached Rio, and invaded the greater part of the country, but did not spread southwards to La Plata. In 1858 it again broke out at Rio, and in 1862 and 1863 at Pernambuco, Rio, and Maroim. (Hirsch.) In 1866–67 the disease broke out in the south, in Paraguay and Uruguay, from whence it was introduced in 1867 into Brazil. It appears to have been chiefly restricted to the south of the country during this epidemy. The last visitation of the disease, and that of a limited extent, occurred in 1868.

Dysentery is more or less prevalent throughout the country. Sigaud reckons it as one of the severe endemic diseases of the province of Para. The Amazon valley is not free from the disease, which is here met with from time to time in an epidemic form. It is stated to be of rather frequent occurrence in the provinces of Maranhao, Piauhi, and Parahyba, to the south; but its relative prevalence in the different districts cannot be ascertained. At Pernambuco, dysentery is met with, but it is not prevalent or fatal, causing only two deaths per 10,000 living, and 3 per 1000 of the deaths from all causes.[1]

At Rio, diarrhœa and entero-colitis must be of frequent occurrence, since they formed about 12 per cent. of the admissions from the diseases we have specified into the Miséricorde Hospital. In the southern provinces of San Paulo, Parana, Sta Catherina, and Rio Grande do Sul, diarrhœa is less prevalent. Bourel-Roncière records an epidemy of dysentery occurring in Rio, in the months of December and January 1863–64, of a distinctly intermittent character. The evacuations stopped during the day, and came on towards 9 or 10 o'clock P.M.; and this return coincided almost invariably with fever, sleeplessness, and agitation.[2]

A strange malady, described under the name of "él Bicho," and supposed by some to be a species of dysentery, but not, so far as I know, met with in Rio, is said by Sigaud to attack the people inhabiting the marshy districts, and the low humid localities in the tropical parts of the Republic, and the dwellers in towns where putrid emanations abound. The Indian population suffer from it when they leave their mountains to reside in the hot and humid plains. It has also been observed when grave bilious fevers have been epidemic. In this disease the rectum or transverse colon becomes gangrenous, and exhales a putrid odour. It is accompanied by fever, fainting, and a tendency to somnolence. This is evidently the same disease as the Caribi sickness of British Guiana and allied to the gangrenous malady of Fiji.

Smallpox, which is said to have been imported from Africa in 1650, has proved, even during this century, a terrible scourge, particularly to the coloured population, and was much more severe in the eighteenth century.

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[1] Béringer, *Ann. de la Soc. Meteorolog. de France*, 1879.

[2] *Archiv. de méd. nav.* vol. xix.

Scarlet Fever, which was rare during the first three decades of this century, has of late years been frequently epidemic, and has made many victims.

Measles is met with from time to time in all parts of the Republic in an epidemic form, and it does not here exhibit that mildness of type which we have observed to characterise it in some warm countries, such as the West Indies.

Bronchitis is not marked by any special frequency or fatality in Brazil, although it is by no means rare in the southern provinces.

Pneumonia is also met with throughout the country. At Rio it accounts for about 2·6 per cent. of the medical admissions to the hospital. The accompanying fever is not infrequently seen to assume an intermittent form, or to be complicated with intermittent fever.

Phthisis is excessively prevalent along the coasts of Brazil from north to south. At Pernambuco it gives rise to a mortality of about 5·2 per 1000 living; at Rio, of 5·0; and at Sta Catherina, of 3·9 per 1000. At Para, in the extreme north, the deaths from phthisis form about one-fifth of the total mortality. At Rio the disease has been increasing in frequency of late years. In 1855–58, the deaths from consumption formed 14 per cent. of the deaths from all causes; in 1867–69, the ratio was 20 per cent.

Diseases of the Liver.—Hepatitis, acute, subacute, and chronic, is common in Para.[1] At Pernambuco, where, as we have seen, dysentery is rare, hepatitis causes 47 per 1000 of the total deaths. At Rio, hepatitis furnishes about one in twenty of the medical admissions; but tropical abscess of the liver is not common.

Lymphangitis is more common in Brazil than in any other part of the world, and is regarded by many as a special form of malarial infection. It may occur either in a local and circumscribed, or in an erratic and diffused form; further, it may affect the superficial or the deep glands; and it may end in resolution, suppuration, or gangrene, the latter being a common termination when the disease attacks the scrotum or mamma. Locally, there are swelling and tenderness of the glands affected, and if the disease is superficial, there will be redness of the skin. The constitutional symptoms are rigors, which are followed by fever and sweating, and these accessions may follow the quotidian or tertian type. In grave cases the fever may be continued, and typhoid symptoms often supervene. In the erratic form, the disease occasionally attacks the joints, and terminates in resolution, or in suppuration and anchylosis. The membranes of the brain may be affected. Whatever may be the true nature of the disease, it is often associated with a prevalence of malarial fever, as I have myself witnessed in Mauritius.

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[1] *Archiv. de méd. nav.* vol. xviii.

In Rio, the monthly mortality from this disease, from 1868 to 1876, was as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
74	54	55	47	45	53	53	87	110	134	117	162=991

Lymphangitis has become more common of late years, and this has been ascribed by some to the mephitic effluvia arising from the new drainage canals, which were begun in 1862 and completed in 1866. It must not be forgotten, however, that the disease was prevalent long before that date. Sigaud mentions it as among the endemic maladies of Rio when he wrote in 1836. Lymphangitis does not occur on the heights that surround the city. It is rare in infancy, but becomes more common after puberty. It affects both sexes. The mulattos suffer from it more than the negroes. It is by no means restricted to Rio, but is met with in marshy districts in other parts of the country; but we have no data for determining its distribution and degree of prevalence in the several regions of the Republic.

Beriberi must be mentioned as one of the endemic diseases of Brazil, being now widely diffused over the country, and sometimes assuming an epidemic form (*Gaz. Méd. da Bahia,* 1872).

Leprosy is exceedingly common throughout Brazil, with the exception of the provinces of Maranhao and Rio Grande. It is met with both along the coast and in the interior. The provinces of Menas and San Paulo appear to be those in which leprosy is most prevalent.

Syphilis prevails in Brazil to an extent to which it is difficult to find a parallel in any part of the world, and causes a very high mortality. In Pernambuco one per cent. of the deaths are caused by syphilis; it is also excessively frequent in Bahia and Rio. The cause of this is the very low state of morality among the people. Vices of such a description as at home are never even alluded to, are here the subjects of common conversation, and are boasted of as meritorious acts.[1] The Indian tribes in the interior who have not come in contact with Europeans are exempt from the disease. Ehrenreich, referring to the Carajahi tribe, says that syphilis has not yet appeared among them.[2]

Frambœsia or *Yaws,* locally known as boubas, affects the negro and white population, but is not found among the native Indians.[1]

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[1] Wallace, *Travels on the Amazon,* Lond. 1889.

[2] *Proc. R. G. S.*, 1890, p. 44.

Elephantiasis is very common.

Rheumatism is moderately prevalent.

Diseases of the Heart give rise to 35 per 1000 of the deaths in the Miséricorde Hospital; syphilis shares with alcoholism the blame of causing diseases of the heart and great vessels.

Tetanus, affecting adults as well as infants, is very common; and *convulsions* cause a very considerable although not excessive mortality in children under seven years of age.

Goitre is stated by Hirsch to extend over the whole country, excepting the coast territory and the alluvial plains.

Cancer appears to be rather rare.

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[1] Bourel-Roncière, *Archiv. de méd. nav.* vol. xviii.

CHAPTER IX.

ECUADOR AND PERU.

ECUADOR.

GEOGRAPHY AND CLIMATE.—Ecuador, wedged in between Peru on the south and Colombia on the north, is triangular in shape, the base being turned towards the Pacific Ocean, and the apex abutting on, or jutting into, the territory of Brazil. It extends from 1° 40′ N. to 5° 50′ S. lat., and from 68° to 81° 20′ W. long., measuring about 500 miles along the Pacific from north to south, and 850 miles from west to east. The area is estimated at 144,000 square miles, and the population at 1,000,000. The country is traversed by the continuation, northwards, of the Peruvian Andes, enclosing table-lands from 8000 to 10,000 feet in altitude, which are dominated by the snow-capped peaks of Chimborazo, Cotopaxi, Antisana, and Cayambe. On the west, the chief rivers are the Guayaquil, the Esmeraldas, and the Mira. On the east, it is drained by tributaries of the Amazon. In the basin of the Guayaquil there is a rainy season lasting from December to May, which is also the hot season. Rain seldom falls along the coast between Guayaquil and Cape Lorenzo. The mean temperature at Guayaquil is 26° C.

Quito, the capital, at an elevation of 9492 feet, has a mean temperature of 15° C., and this temperature does not vary more than two degrees throughout the year.

At Antisana, at about 14,000 feet, the mean temperature of the year is 4°·9 C.

Guayaquil, the chief port, has a population of about 25,000. It stands on the right bank of the river of the same name, in lat. 2° 11′ S.

PATHOLOGY.—Intermittent fevers, benign and pernicious, are frequent at Guayaquil during the wet season.

Yellow Fever has been twice introduced into this port, once in 1740 and again in 1842.

Typhoid Fever has been frequently observed.

Dysentery and *Hepatitis* are also common and fatal here during the rains.

Phthisis and *Bronchitis* are very common.

The capital is free from malaria, and also from phthisis; as are the high lands generally. Of Quito, Gayraud and Domec, quoted by Hirsch, say, "Our personal experience permits us to affirm, that consumption is so rare that it may be said not to exist, at least as a disease arising in the country itself. . . . The fact is for us indubitable, that one does not become consumptive at Quito." The regions east of the Andes are under the same conditions as the Montaña of Peru, presently to be described.

Leprosy is endemic in the elevated regions, and is met with, but less frequently, along the coast, and in the upper basin of the Marañon (Hirsch).

Goitre is prevalent in the Cordilleras.

PERU.

GEOGRAPHY.—Peru is bounded on the north by Ecuador, on the south and south-east by Bolivia, by the Pacific on the west, and by Brazil on the east. Its length is 1300, and its breadth 780 miles. Its area is about 503,380 square miles, with a population of 3,374,000, of which 57 per cent. are Indians, 22 per cent. Mestizos, and the rest whites, negroes, and mulattos.

Peru is divided into three regions—the Coast, the Sierra, and the Montaña.

The Coast tract, lying between the Andes and the ocean, varies from 30 to 70 miles in breadth. Naturally, it is a sandy desert, which is intersected by about sixty rivers, descending from the Andes, and imparting fertility to the valleys through which they flow. Many of these streams become dry in summer. The Sierra comprises the whole region of the eastern and western ranges of the Andes, between which stretch high plateaux and fertile valleys of great extent. The Montaña, forming two-thirds of the entire area of the country, stretches from the eastern slopes of the Cordillera to the western limits of Brazil. Lima, situated 512 feet above the sea-level, and six miles inland, has a population of about 170,000. Callao, the seaport of Lima, has about 22,000 inhabitants.

CLIMATOLOGY.—Iquitos is situated in the Montaña, in lat. 3° 44′ S., and long. 73° 7′ W., at an elevation of 313 feet above the sea-level. The temperature and rainfall at this place, from July 1871 to June 1872, as observed by Galt, were as follows:[1]—

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
Mean Temperature, C.,	24·9	26·1	26·2	26·9	27·2	26·6	26·3	26·7	25·9	26·3	25·7	25·0
Rainfall, inches, . .	4·27	3·94	9·33	7·57	8·42	11·45	10·23	9·86	16·00	8·93	9·99	11·77

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[1] *Proc. R. G. S.*, May 1873.

The temperature of the Sierra varies according to altitude. At an elevation of 9000 feet, the mean annual temperature is about 60° F.; at higher elevations, such as at Pasco (14,000 feet), the climate is extremely cold.

At Lima, the average mean temperature is 67° F.—the extremes being 85° and 57° F. From June to November the thermometer averages 60° F. The city is situated at the head of a plain, not far from the point where the river Rimac debouches from the Cordillera. The cold currents of air coming down the valley of the Rimac encounter the sea winds concentrated at this spot by the funnel-shaped plain, and give rise to the fogs and mists which here supply the place of rain.[1]

PATHOLOGY OF THE COAST REGION.

PATHOLOGY.—*Malaria.*—Callao is decidedly malarious. Hutchinson learned that out of 11,561 interments in the native cemetery of Callao during the ten years, January 1862 to December 1871, "no fewer than 3980 were of persons dying from fever."[2] Moore, writing in 1884, remarks, "that to the left of Callao is a large marsh of rank vegetation, through which the waters of the Rimac flow in their course to the sea. . . . In certain parts of this marshy tract, on the seashore, there is, at high tides, an overflow of salt water, and the result of this admixture of the salt with the fresh water is the production of the malarial poison in an intensified form."[3] A number of the men belonging to the *Satellite* and *Swiftsure* were attacked with fever. The forms of fever at Callao are tertian ague, and pernicious remittent. Monin notices the profound anæmia following attacks of fever contracted at Callao.[4]

At Lima, according to Squire, two-thirds of the population suffer from intermittent fever and its consequences. This is partly to be explained by the hot and humid state of the atmosphere, and partly by the irrigation of the soil of the valley, and the neglect of drainage in the city itself. The coast towns generally, such as Arica and Pisco, to the south of Callao, and Port Ancon and Truxillo, to the north, all suffer more or less from malaria.

Payta, the port of the province of Puira, is healthy. Rain seldom falls here; the climate is hot and dry. There are scarcely any fogs. From October to April is the hot season. In December,

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[1] Squire, *Incidents of Travel in Peru*, London 1877.

[2] Hutchinson, *Two Years in Peru*, London 1873.

[3] *Navy Report*, 1884.

[4] *Archiv. de méd. nav.* vol. xxxix., 1872.

January, and February the temperature may reach 31° or 32° C. In the cold season it never falls below 18° C.[1]

Colon, situated at a distance of three leagues from Payta, in the neighbourhood of marshes, was found by Savatier to have a diminishing population, on account of the frequency of dysentery and intermittent fevers (*Archiv. de méd. nav.*, 1880). Smith has given us some details respecting the health of the country inland from Payta. We learn from him that, about twenty-eight leagues inland, the district is occupied by three large estates, Yupatera, Moropon, and Mono de las Padres. The surrounding hills are clothed with verdure, producing crops of sugar-cane, etc. "When it rains in this province, the river Chiri overflows its banks, and spreads out into stagnant marshes at the three estates just mentioned; while, lower down, the stream is almost altogether absorbed and swallowed up in its sandy channel. From 6 A.M. to 6 P.M. you have all the region bathed in glowing sunshine, and at sundown an icy wind from the Cordillera blows over the heated plains, insomuch that no clothes can protect one from its chilling midnight effects. During the season of inundations, near the foot of the Andes of Yupatera, the malaria on this property is so intensely active that it produces the most malignant remittent and intermittent fevers, which often prove fatal on the first, second, or third accession. In other instances, the endemic fever of this locality assumes the continued type, with a duration of two or three weeks, during much of which time the patient lies *atrabardillado,* or in an insensible state of fever with delirium. . . . The whole inhabitants of the district who survive the endemic fevers become subject to chronic disease, with enlargement of the spleen and liver, while the negro race are the only human beings who thrive on it. Epistaxis is a frequent concomitant in the malignant malarial fevers of the coast and deep inland valleys of Peru."[2] Perhaps this continued form is rather typhoid than malarial.

Typhoid Fever is said by Fournier to be common in Callao.[3] Hunter states that it is rare in Arequipa.[4] Its presence has not been noticed in the other towns of Peru.

Yellow Fever made its first appearance in Peru in 1854, and, according to Hirsch, was never absent from that date up to 1869. I have no later information upon this subject.

Diphtheria is said by Smith to have been seen for the first time in Lima as far back as 1826, and to a limited extent in 1850-51. It was very fatal in 1858-59.

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[1] Lantoin, *Archiv. de méd. nav.*, 1872.
[2] *Trans. Epidem. Soc. London*, vols. ii. and iii.
[3] *Archiv. de méd. nav.*, 1874.
[4] Hunter, *Practitioner* for 1881.

Dysentery is frequently met with along the coasts of Peru, and also at Lima, where it is known as "él Bicho," and causes a high mortality. It is endemic in Arequipa (Hunter). It is common at Payta, where there is no fever.[1]

Hepatitis is very common in the Coast region, and often ends fatally.

Pneumonia and *Pleurisy* are remarkably common along the coasts, and epidemies of *Typhoid-Pneumonia* have also been observed.

Phthisis is generally prevalent in all the Coast districts; and, according to Rey, it is particularly common at Payta, in the north, and may be regarded, in fact, as the dominating malady of the coast country, causing three-tenths of the total mortality.

Leprosy is unknown on the coast of Peru.

PATHOLOGY OF THE SIERRA.

Malaria.—The higher lands of the Sierra are, as a rule, free from malaria, but a remarkable epidemy of what is known as the Oroya fever occurred at a great elevation, during the construction of the railway in 1870–71. The name of Oroya fever was given to it from the fact that the fever occurred on the Oroya railway line; but the epidemy really broke out at about 100 miles from the small town of Oroya. The most of the cases occurred at or near Coca Chacra, at an elevation of 4888 feet above the sea-level. The sufferers were working all day as navvies, with the temperature at 90° F., and drinking freely. There was no marsh near; but, as it is said that the workmen were employed in preparing for the iron bridges, the district was certainly not destitute of water. Hutchinson, from whose work, already quoted, I take these particulars, says that the records of death from this epidemy, in the Guadeloupe hospital at Callao, where the patients were sent for treatment, are almost incredible. The disease was of the tertian type, but almost always accompanied by fatal liver derangements, "from which scarcely one in a hundred recovered." It is to be regretted that fuller details of this epidemy have not been given; for malaria is not endemic on the high table-lands of Peru.

Relapsing Fever has been seen by Baldow at elevations from 1500 to 4000 mètres.[2]

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[1] *Archiv. de méd. nav.*, 1880.

[2] Gay, *Méd. de Paris*, 1865, p. 295, quoted by Lombard. Lombard refers to the *American Journal of Med. Science*, but does not give the number of the volume.

Typhus has been frequently observed in the Sierra.

Dysentery is said to occur, and sometimes in a malignant form, in the country between Jacna, Moquehua, and Arequipa, on the banks of the Tijenani, at the height of 8000; in Huanuco, and even in the town of Cerro Pasco, at a height of 13,000 feet (Hirsch).

Pneumonia, *Pleurisy*, and *Bronchitis* are very frequent throughout the Sierra; but *Phthisis* is seldom seen.

The *Peruvian Wart* or *Veruga* is peculiar to this region, especially to the western slopes of the Andes, and is more common and fatal at higher altitudes. It appears in the form of small tumours, varying in size from a pea to that of a pigeon's egg, of a dark reddish colour, which become fissured, and give rise to hæmorrhages which often prove fatal. The warts may be few or numerous, and are most commonly met with on the extremities and face. The duration of the disease is from two to eight months. It often proves fatal from hæmorrhage, or from the consequent anæmia.

Goitre is endemic in the central valleys of Peru. (Hirsch.)

PATHOLOGY OF THE MONTAÑA.

Malaria.—The Montaña region appears to be, upon the whole, healthy. According to Galt, in the article already quoted, intermittent fever is prevalent all through the dry season, and particularly at its close; but he adds, that it is remarkably tractable. Lombard mentions that this same writer observed an epidemy of intermittent fever, complicated by abscesses and pulmonary and other hæmorrhages.[1]

Complaints of the Liver and *Dysentery*, Galt says, are rare, "and present none of the unfavourable features which characterise those complaints, as found in the British East Indies. Even the greatest exposure here is followed but rarely by bad effects, and the slightest prudence is sufficient to enable the native or stranger to enjoy very good health." The disorders most commonly met with in the valley of the Marañon are catarrhal affections and rheumatisms, about the change of seasons.

According to Galt, *Syphilis* is unknown in the basin of the Ucayali. The disease is said to have been quite unknown in South America before the Spanish conquest, and the tribes in the interior, where they are out of contact with European settlers, have remained free from it up to the present time, as we have seen to be the case in Brazil.

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[1] Lombard refers to the *American Journal of Med. Science*, but does not give the number of the volume.

CHAPTER X.

BOLIVIA AND CHILI.

GEOGRAPHY AND CLIMATE. — Bolivia, or Upper Peru, extends between 9° and 26° 15′ S. lat., and 57° 20′ and 72° 40′ W. long., occupying an area of 500,870 square miles, with a population estimated at 2,325,000. It touches the Pacific by a narrow strip of coast between Peru and Chili. Like Peru, it consists of three distinct regions—1. The Coast district; 2. the Sierra; 3. the extensive territory to the east of the Andes, in which arise the tributaries of the Amazon and the Parana, consisting of plains or pampas, often dry and sandy, such as the Gran Chaco, and of immense forests or selvas. The only river on the coast line is the river Loa. Cobija is the only town of importance situated on the coast.

Orura, the capital, situated in the interior, has about 8000 inhabitants. The most important town, however, is La Paz, with a population of 77,000.

Cochabamba, Chuquisaca, and Potosi are also places of some importance.

PATHOLOGY.—The climate of the sea-coast is excessively dry, and perhaps for this reason the Coast region is free from malaria. In the Sierra the climate and diseases are similar to those of the corresponding region of Peru. The shores of the great lake of Titicaca, at a height of 12,846 feet, are free from fevers.

Phthisis is unknown, both among the Indian and white population of the Sierra. Even the miners escape the disease.

Intermittent, Remittent, and *Bilious Remittent Fevers* occur on the banks of the rivers on the eastern slope of the Andes. Rey states that the Bolivian Government, when it inclines to clemency, sends the condemned here to die.

But it must be remembered that here we are dealing with a vast region, which, as it includes open sandy plains and dense forests, so doubtless varies in regard to salubrity; and it is just in respect to the localities where fever prevails that we know next to nothing. Lombard says that it is on the marshy banks of rivers which have been overflowed after the melting of the snow that fever rages sometimes in an epidemic form. It would appear, however, that the dry pampas are by no means free from fever, but that, taking this region as a whole, the Montaña region of Bolivia is comparatively healthy.

CHILI.

GEOGRAPHY.—Chili is a narrow belt, lying between the Andes and the shores of the Pacific Ocean, extending from the southern coast boundary of Bolivia, in 26° 15′ S. lat., down to Cape Horn, including Patagonia,[1] the Chiloe Archipelago, and numerous islands along the western coasts.

The extreme length of Chili is 2200 miles, and its average breadth, north of latitude 40°, is 100 miles. The population in 1885 was 2,524,476.

The country is divided into a flat coast strip, and a series of elevated table-lands and valleys, formed by the lower longitudinal ridges between the Andes and the coast, and their connecting spurs; and by the terraces on the slopes of the main chain of the Andes, which here rise to a general elevation of 13,000 or 14,000 feet, reaching in Aconcagua to the height of 22,296 feet, the greatest elevation in the New World.

To the north is the great desert of Atacama, part of which is in Bolivia and the rest in Chili. Here fifty years may pass without a shower of rain. The whole coast down to Coquimbo (30° S. lat.) is arid, and almost destitute of rivers, and the streams are far apart. To the south of Valparaiso the country becomes better watered, and the rivers, Maule, Biobio, and Calacalla, permit the passage of small craft. Between Valparaiso and the Biobio the country is agricultural. South of this river it is pastoral or in forest.

The capital is Santiago, a city of 150,000 inhabitants, situated about 100 miles inland, at the western base of the Andes, at an elevation of 1800 feet; it is connected by railway with Valparaiso (Vale of Paradise), the principal port of the country. The other coast towns are Copiapo, Huasco, Coquimbo, Concepcion, and Valdivia.

The Chiloe Archipelago, off the south-west coast, in lat. 41° to

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[1] After the war with Bolivia and Peru (1879–81), Chili acquired the coast formerly belonging to Bolivia, and the Peruvian province of Tarapacá.

43° S., is in part low and swampy, and in part hilly and covered with primeval forest. The only cultivated land is along the coast.

Patagonia stretches from the Chilian and Argentine frontiers to the Strait of Magellan. It is occupied by a few Indian tribes, with a small colony of Chilians settled at Punta Arenas. There is also a Welsh colony, numbering 690 souls, located at Chubut or Chupat, about 40 miles inland.

CLIMATOLOGY.—The climate of Chili presents the greatest variety, both as regards temperature and rainfall. Monin gives the mean temperature of the seasons in some of the principal towns, as in the subjoined table:—

	Seréna, 3 leagues from Coquimbo.	Coquimbo.	Valparaiso.	Santiago.	Valdivia.
Summer (Dec. to March), .	17·52	18·42	16·62	18·45	14·76
Autumn (March to June), .	15·12	15·82	13·75	12·68	11·26
Winter (June to Sept.), .	12·14	12·85	11·41	7·39	7·14
Spring (Sept. to Dec.), .	14·38	15·52	13·09	13·06	10·89

We learn from the same authority that it rains only about once a year at Copiapo, and three or four times a year at Coquimbo; at Santiago and Valparaiso it rains on an average twenty-five times, and at Valdivia in the south, one hundred and fifty times a year.

The climate of the Chiloe group is humid. The rainfall, about 96 inches. The wettest months are from May to August. The mean annual temperature is 11°·1 C. The warmest month is January, with a mean temperature of 15°·8; the coldest, June, with a mean temperature of 7°·7.

PATHOLOGY.—*Malaria.*—Hirsch informs us that "Chili was formerly quite exempt from malaria, but since 1851 it has been visited by pernicious epidemics, and at a few points in that country the disease has assumed an endemic character." This is certainly an important fact in the history of malaria,[1] for which I give the original authorities.

Malaria is endemic at Coquimbo, Valparaiso, Talcahuano, and Concepcion, and on the banks of the Biobio, near its mouth; but, according to Martin, malaria is little known in Chili generally.[2]

Valparaiso is built on a narrow strip of sand, between the sea and the hills. The town is divided into two parts: that near the harbour, which is low; the other rising, as an amphitheatre, in successive terraces. The upper part of the town is probably non-malarious, but the level part is not entirely free from fever. A few cases of intermittent fever were contracted by men of the French war vessel *Astrée*, while lying in the roadstead (Lantoin, *Arch. de méd. nav.* vol. xvii. p. 165). The admissions from fever among the Chilian troops stationed here in 1877–78 were in the comparatively small ratio of 52·4 per 1000.

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[1] Hirsch gives the following authorities for these statements:—Lafarque, *Bull. de l'Acad. de Méd.* xviii. 189; Bibra, *Reise in Süd. Amerika*, 1854; Boyd, *Edin. Med.*, August 1876; Pideret, *Deutsche Klin.*, 1853; Le Roy, *Archiv. de méd. nav.*, 1864.

[2] *Die Krankheiten im Südlichen Chile*, Berlin 1885.

Intermittent Fever is unknown in the Chiloe Archipelago; but Martin[1] observed two cases of enlarged spleen in children living in a swampy locality. This seems to show that the malarial poison in its most attenuated form may show itself in enlargement of this organ without inducing fever.

Typhoid Fever is rather common at Valparaiso, and is also met with at Santiago. In the Chiloe Archipelago typhoid fever exists, and is sometimes epidemic.

Typhus has been noticed by numerous observers in Chili, where it is not unfrequently epidemic. Martin also testifies to the fact of its epidemic prevalence at times in the Chiloe group.

Yellow Fever has, up to the present time, not been introduced into Chili.

Influenza has not omitted to visit Chili, when it has been epidemic in the neighbouring countries. Musters observed a fatal outbreak of the disease among the native children in Tierra del Fuego during his travels in that country.[2]

Cholera.—Chili is fortunate in having hitherto escaped this pestilence.

Dysentery causes rather more than one-tenth of the total deaths in the Charité Hospital at Valparaiso. Martin states that dysentery is met with all over the country.

Smallpox appears in virulent epidemies, especially among the Indians and the coloured population.

Scarlet Fever made its first appearance in Chili about the year 1832, and since that time frequent epidemies of the disease, some of which have been of a malignant type, have been witnessed.

Measles is also frequently seen in an epidemic form. This disease was introduced into Tierra del Fuego by Commissioners appointed by the Chilian Government to visit that country about the year 1871.

Phthisis makes many victims all along the coast of Chili, and it is here observed to run a rapid course. In Valparaiso, more than one-third of the deaths in hospital are due to consumption. The mountain districts, however, are exempt from the disease. It appears to be met with at the present day in Tierra del Fuego; but if the following account given by a French *savant* can be trusted, consumption was not originally endemic in this country:[1] "Les habitants de la Terre de Feu n'ont jamais connu la tuberculose avant l'invasion anglaise. La femme d'un missionnaire, tuberculeuse pulmonaire, fonde une école pour civiliser les jeunes sauvages, et elle ne réussit qu'a les tuer. L'épidémie de tuberculose pulmonaire, apportée à la Terre de Feu par la femme du missionnaire, décima la pauvre population."

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[1] Martin, *Die Krankheiten im Südlichen Chile*, Berlin 1885.

[2] *R. Geo. Soc. Trans.*, 1871.

There is something in the way in which this story is told that suggests the desirability of obtaining further information before accepting the narrative as of scientific value.

Pneumonia is very common at Valparaiso, where it occasions 189 per 1000 of the deaths occurring in hospital.

Pleurisy gives rise to 5 per 1000 of the total hospital mortality.

Bronchitis is also far from rare.

Lantoin[2] states that the most common affections at Valparaiso are sore throat, bronchitis, rheumatism, and neuralgia, the latter curable by quinine.

Hepatitis and *Liver Abscess* are frequently met with at Valparaiso and in the north of Chili, but towards the south they are seldom seen.[3]

The deaths from *Rheumatism* form 4·4 per 1000 of the total hospital mortality,—a proportion which is pretty similar to that which is observed in many towns of Northern Europe, such as Copenhagen.

Syphilis is excessively prevalent at Valparaiso, where it causes 57 per 1000 of the deaths in the Caridad Hospital (Fournier).

Scrofula, according to Poeppig, is only seen occasionally among the residents of the northern part of the country at the foot of the Andes.[4]

Goitre is endemic in some of the hilly districts.

Leprosy is not met with in Chili.

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[1] *Tribune Médicale*, Dec. 5, 1889.

[2] *Archiv. de méd. nav.*

[3] Martin, *Op. cit.*

[4] *Med. Chir. Rev.*, Jan. 1837.

CHAPTER XI.

ARGENTINA, PARAGUAY, URUGUAY, AND THE FALKLAND ISLANDS.

GEOGRAPHY AND CLIMATE.—LA PLATA, or the Argentine Republic, extends from 22° to 41° S. lat., and from 54° to 72° W. long., having Bolivia and Paraguay on the north, Patagonia on the south, the Chilian Andes on the west, and Paraguay, Brazil, and Uruguay on the east. The area is about 1,185,086 square miles, with a population of 2,952,800.

The country is divided into fourteen provinces, viz.:—1. Buenos Ayres; 2. Parana or Entre Rios; 3. Santa Fé; 4. Corrientes; 5. Jujuy; 6. Salta; 7. Tucuman; 8. Catamarca; 9. Santiago del Estero; 10. Rioja; 11. Cordova; 12. San Juan; 13. Mendoza; 14. San Luis. The Republic also claims a portion of Le Grand Chaco in the north, and a part of Patagonia in the south.

The provinces of Jujuy, Salta, Catamarca, Rioja, San Juan, and Mendoza, in the north-west, are hilly. The Grand Chaco, in the north, is a sandy desert, with scanty vegetation, except where, along the Paraguay, the Bermejo, and the Pilcomayo, it becomes converted into immense marshes and jungles by the inundations of these rivers. Another barren tract is the district called Las Salinas, in the centre of the country. To the south are vast undulating pampas or plains, destitute of trees, covered with tufty grass, on which cattle, sheep, horses, and mules are reared. To the east are the provinces of Parana and Corrientes, between the Parana and Uruguay Rivers, along both of which immense swamps are found. La Plata is well watered by the Parana and Uruguay, and their numerous tributaries. Buenos Ayres, the capital, with a population, in 1887, of 459,663, is situated on the right bank of the Plata River.

At Buenos Ayres the mean temperature of the year is 16°·9; that of winter, 11°·4; spring, 15°·2; summer, 22°·8; and that of autumn, 18°·1 C. The temperature here is liable to rapid fluctuations, varying with the winds. In summer the thermometer often rises to 30° or 32° C. The temperature of the mountainous regions adjoining the Andes varies widely according to altitude. In many districts it presents a great annual fluctuation, the heat of summer being extreme, and the winters cold.

The following, according to Hann, is the temperature of four of the north-western districts arranged from north to south:—

Locality.	Latitude.	Altitude, Mètres.	Temperature.				
			Jan.	April.	July.	Oct.	Year.
Salta, . . .	24° 47′	1200	21°·5	16°·7	11°·3	17°·9	17°·0
Tucuman, . .	26° 50′	480	25·1	19·8	12·3	21·4	19·4
Rioja, . . .	29° 19′	540	28·4	20·3	12·6	24·0	20·6
Mendoza, . .	32° 53′	840	23·8	16·0	7·8	17·4	15·9

We shall add the temperature of four localities, as illustrating the climate of the eastern plains:—

Locality.	Latitude.	Altitude, Mètres.	Temperature.				
			Jan.	April.	July.	Oct.	Year.
Santiago del Estero,	27° 46′	210	27°·6	21°·1	12°·4	23°·1	21°·6
Cordova, . .	31° 24′	470	22·8	15·6	9·1	17·7	16·6
Corrientes, . .	27° 28′	70	26·3	21·7	15·8	21·5	21·5
Parana, . . .	31° 43′	115	26·1	19·6	11·7	17·8	19·1

In Buenos Ayres the period of heavy rains extends from October to February.

Paraguay lies between the rivers Paraguay and Parana, extending from 22° 4′ to 27° 35′ S. lat., and from 54° 32′ to 58° 40′ W. long. Its area is estimated at 145,400 square miles, with a population of 476,000. The capital is Asuncion, with a population of about 22,000 inhabitants. The Sierra Anambahy, running from north to south, divides it into two parts, and forms the watershed between the Parana and Paraguay. The country in general consists of rich, undulating, alluvial, grassy, treeless plains, except along the river banks, where, in many places, strips of forest are met with. Large tracts of marshy land abound throughout the country. The temperature of Asuncion, 100 mètres above the sea-level, is—January, 26°·2; April, 22°·6; July, 17°·4; October, 23°·8; and of the year, 22°·4 C.

Uruguay is bounded on the north by Brazil, on the east by the Atlantic, on the south by the Rio de la Plata, and on the west by the Uruguay River. The area is 70,000 square miles, with a population of 700,000. The only important river, besides the Uruguay, is the Rio Negro, which joins the Uruguay some way up from its mouth. The country consists chiefly of grassy plains, although in the centre, which is occupied by the prolongation of the Sierra do Mar, it is hilly, rugged, and covered with forest.

The capital, Monte Video, in 34° 54′ S. lat., is built upon a slight raised promontory; the soil is rocky, with a sufficient slope to carry off the rains. Its population (1879) was estimated at 105,000.

Spring commences on September 21st; summer, in December; autumn, in March; winter, in June.[1] The mean temperature of the year is 16°·8; that of January, 22°·8; that of April, 17°·8; that of July, 10°·9; and that of October, 16°·2. Féris has seen the daily range of temperature reach 17°·4. In the course of a single day, he says, one passes through all the seasons of the year. The annual rainfall is 1100 mm.; the wettest seasons are spring and autumn, especially the months of October and May.

Pathology.—*Malaria.*—The results of earlier and later experience respecting the health of this region do not in all respects agree. We shall state the facts, so far as they are ascertained, respecting the several localities.

The city of Monte Video is free from malaria; and if intermittent fevers are met with in Buenos Ayres, they are extremely rare. The southern shores of Uruguay and the coasts of the province of Buenos Ayres are also exempt from malaria. Respecting the low sandy Atlantic shores of Uruguay and the neighbourhood of Lake Merim and that of the L. dos Patos, we have no trustworthy information. The town and neighbourhood of Rosario are healthy, and Parana enjoys a good reputation for salubrity. The southern provinces are also free from fever. On these points all authorities are agreed. But the marshy districts to the north of the three States are certainly not exempt from malaria, as was formerly supposed to be the case. The banks of the Uruguay in its upper part are to some extent subject to malaria, although Bompland, who resided for eighteen years at San-Borja, on the left bank of the river in its upper course, saw only two cases of intermittent fever during that time. But such was not the experience of the ships of war that visited this river in 1867–69. Their crews suffered severely from malarious fevers. It does not, however, follow that the town and neighbourhood of San-Borja is malarious. The error lies in assuming that because this town is healthy, the whole of an extensive country is the same. Mantegazza's statement, quoted by Hirsch, to the effect that paludal fevers are unknown on the banks of the Rio de la Plata, is entirely supported by modern experience, if by that we mean the gulf so called; but it is different in respect to the banks of the Parana and Paraguay Rivers above the town of Parana. Corrientes is situated at the junction of the Parana and Paraguay, near to immense lagoons stretching to Ybera. The north-west winds, which are frequent here, are hot and humid, and are supposed to bring marsh miasm with them. The natives blame it for causing fever and neuralgia. The mean temperature in summer is from 25° to 28°; but with a S.-W. wind it falls rapidly to 22°. After entering the Paraguay, we find the Gran Chaco desert on the right bank, which is periodically inundated. On the left bank is a vast extent of uncultivated land, also subject to inundation. Both banks are malarious, the left especially so. At Palmas, fifteen leagues from Asuncion, the men of *La Décidée* were attacked with an epidemy of bilious remittent fever.

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[1] Féris, *Archiv. de méd. nav.* vol. xxxii.

Azevedo states[1] that marsh fevers seem to absorb the pathology of Paraguay. Intermittents, known as "chucho" by the natives, are recognised by him as endemic. At Itāpirú, Curusú, and at Curupaïty, he says they developed with intensity, and it was the same upon the whole bank of the river, and in the Campos of Paraguay. These intermittents, which were either simple or complicated, ended very often in pernicious, bilious, or remittent fevers. They attacked the men at all periods of the year, but chiefly during the heat of summer.

At Asuncion, the capital, from February to December in 1869, there were in all 3916 admissions. Of these, 763 were cases of intermittent fever; 30 were cases of pernicious fever, of which 7 died; there were about a hundred cases of other types of fever, remittent, bilious, masked, and typhoid, also 55 cases of malarial cachexia; in all, nearly one-fourth of the admissions were from malarious diseases. The cold months, July, August, and September, were found to be healthy.

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[1] "Histoire Méd. Chir. de l'escadre Brésiliénne dans les Campagnes de l'Uruguay et du Paraguay, 1864–69," par le Dr. Azevedo, *Archiv. de méd. nav.* vol. xxiii.

The chief cause of malaria, according to Azevedo, is the vast marshes existing in these regions; but the turning up of the soil, in the construction of ditches and other works of defence, increased the evil. When, therefore, Mantegazza says "that intermittent fevers have not that gravity that one might expect in such a latitude and amidst such moisture," we must conclude that he did not study the climate under the same conditions as those experienced by the Brazilians during the campaign of 1864 and 1869, or that his experience was limited to certain healthy localities. Martin de Moussy's statement, that intermittents only begin north of the 28th degree,[1] is only supported by the experience of the campaign to this extent, that they are much more prevalent and severe north of this parallel. In the northern provinces of the Argentine—Jujuy, Salta, Tucuman, especially in the last—fevers are common after the heavy rains of summer (Moussy). The southern part of the Argentine Republic and of Uruguay are free from fever. Malaria is thus endemic in the marshy regions watered by the Parana, Paraguay, and to a less extent on some parts of the Uruguay, in many parts of the Gran Chaco, and in the north-west provinces of Argentina; but the non-marshy regions, even in the north, and the southern provinces generally, are healthy.

Typhoid Fever is endemic throughout the whole of this region. There is always more or less of the disease in Monte Video, and sometimes it assumes an epidemic form. According to Saurel,[2] typhoid fever caused, from 1850–53, a ratio of 30·7 per 1000 of the total deaths. Taking the average of the three years, 1871, 1875, and 1877, the proportion was 19 per 1000, which is still a high ratio compared with that of England, where typhoid fever formed, in 1884, only 12 per 1000 of the deaths from all causes. We have already seen that typhoid fever was one of the diseases from which the allied troops suffered on the Parana and Paraguay. The disease appears to be by no means rare in the central provinces of the Argentine Republic, where it is said to be most prevalent in summer (Lombard).

Typhus is unknown in these countries.

Yellow Fever was introduced from Brazil into Monte Video in 1857, and it appeared the following year in Buenos Ayres. In 1869–70 it prevailed in Asuncion, and in the latter year at

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[1] *Description géographique et statistique de la confédération Argentine*, Paris 1864.

[2] Saurel, *Essai d'une climatologie médicale de Monte Video*, etc., Mont. 1851 (quoted by Lombard).

Corrientes and Buenos Ayres. It was again introduced into Monte Video from Pernambuco in 1872 (Hirsch). It is observed by Lombard that the coloured population was spared during these outbreaks, while they succumbed in great numbers during the outbreaks of cholera.

Asiatic Cholera appeared in this region for the first time in 1866, during the war carried on by Brazil and the Argentine Republic against Paraguay. The Paraguayan and the allied armies were encamped near to the confluence of the Parana and the Paraguay. The disease appeared in April in the Paraguayan army, whence or how has not been discovered, and soon spread among the soldiers of the Confederate army, and, with temporary breaks during winter, it followed both the army and navy to the end of the campaign. It was soon carried by vessels from the camp to the town of Corrientes, and extended to the surrounding country, dying out during the succeeding winter. In January 1867, it broke out anew among the troops, and also at Corrientes, spreading westwards and southwards, reaching Buenos Ayres, which, by strict enforcement of quarantine, had hitherto escaped, in December, where it was very fatal. The epidemy again subsided during the winter of 1867; but in the summer of 1867–68 it appeared afresh in the districts previously affected, attacking Monte Video and the towns on the Uruguay River for the first time, having been brought from the upper river by the wounded soldiers, and carrying off 1947 in the department of Monte Video alone. It again died out during the winter of 1868, but reappeared in the summer of 1868–69 in some of the inland provinces of the Argentine Republic, and spread westward to Bolivia and Peru, extending to the Pacific coast. Since that time this region has been free from the disease. (Hirsch.)

Dysentery and *Diarrhœa* are by no means rare along the coasts. The former occasionally becomes epidemic, and causes a considerable mortality. Sonnet observed an epidemy in Monte Video in the months of March, April, and May, which correspond to the autumn season. From 1850–53, dysentery formed 57·4 per 1000 of the total mortality in this city. During the three years, 1871, 1875, and 1877, the deaths from gastro-enteritis, diarrhœa, and dysentery formed 62·6 per 1000 of the total mortality. In the northern provinces of Argentina and in Paraguay, dysentery is endemic. Dysentery and diarrhœa were common among the Brazilian troops on the Uruguay and La Plata Rivers; the naval force was less affected with dysentery than the troops on shore; but diarrhœa was very severe at the anchorages of Curusú and Curupaïty during the warm months of 1867. In the same year the men of the *Décidée* were attacked with dysentery on the Upper Parana.

The eruptive fevers, *Smallpox, Scarlet Fever*, and *Measles*, are frequently epidemic in the La Plata States. Scarlet fever and measles often appear to assume in this region a very severe type.

Bronchitis is common in Monte Video, Buenos Ayres, and generally, so far as we know, throughout these States.

Pneumonia and *Pleurisy* are stated by Lombard to form about 62·3 per 1000 of the total deaths in Monte Video. In the Brazilian army they caused nearly one-third of the total mortality, which shows that these diseases are common and fatal in the region watered by the Parana, Paraguay, and Uruguay. Martin de Moussy states that the adynamic pneumonia of the Andes, as he terms it, is common and fatal in all the Andine provinces proper, also in Santiago del Estero, Cordova, and San Luis, in the winter season.

Phthisis is rare in the Andine region; but is one of the most fatal, if not the most fatal disease along the coast, especially in the large towns, such as Buenos Ayres and Monte Video, at the latter of which the death-rate from consumption (1875–76) is as high as 2·46[1] per 1000 living, the Spanish population being most affected. It was one of the most fatal diseases of the troops during the campaign in the interior, mentioned above, and its course was observed to be very rapid.

Hepatitis is more fatal in Monte Video and Buenos Ayres than might have been expected in a temperate, and, upon the whole, a healthy region.

According to Lombard, *Diseases of the Liver* form 34·2 per 1000 of the deaths from all causes in Monte Video, and a still larger proportion in Buenos Ayres. Judging, however, from the statistics of Monte Video for the three years, 1871, 1875, and 1877, the proportion given by Lombard is much too high. This comparative frequency of the disease in these places may be suspected to be owing quite as much to the habits of the population as to the climate.

Rheumatic Diseases are excessively common at Monte Video, where they cause 6 per 1000 of the total mortality—a proportion, as Lombard remarks, higher than that which they occasion in any of the towns of Northern Europe. They are equally prevalent in the interior, along the Parana, Uruguay, and Paraguay Rivers, where not only the muscular and chronic forms occur, but where rheumatic fever is also very prevalent.

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[1] Hirsch gives the phthisical death-rate of Monte Video for 1871, 1874, 1875 at 4·0 per 1000; but this is probably a mistake.

Syphilis, although not, perhaps, so common as in Brazil and Chili, is, according to all accounts, very widely spread throughout the La Plata States, not only in the coast towns, but also in the most remote districts of the interior. Dr. Oster assured Tschudi that at Cordova about every third person you meet is syphilitic.

It may not be out of place here to sum up in a few sentences the result of our survey of the distribution and characters of venereal diseases, especially of syphilis, in different parts of the world.

It would be interesting to know whether the gonorrhœal infection coincides in its geographical distribution and its extension with syphilitic diseases; whether, for example, it was absent from countries such as Australia, where syphilis, up to quite recent times, was altogether unknown. I have not been able to obtain any information upon this point. In most accounts venereal diseases are rather referred to as a class, or if any distinction is made, syphilis alone is referred to. It may yet be possible to discover whether those tribes in the interior of South America who have remained free from syphilis are also exempt from gonorrhœa.

No more am I able to say whether soft, or so-called non-specific sores, were known among the races who were exempt from the constitutional malady. It would certainly go far to prove the dualistic theory if we could point to any region in which soft, non-infective chancres are met with, but where the constitutional malady is unknown.

As regards syphilis proper—by which I mean the disease, whatever may be the form of its initial lesion, that is followed by the well-known constitutional symptoms of the infection—it had clearly at one time been restricted within very much narrower limits than it now is.

It has been clearly made out that syphilis was originally unknown in Australia, in New Caledonia, in New Zealand, in the Sandwich Islands, and probably throughout the whole of Polynesia. It is probable, also, that the disease has only within the past three centuries been introduced into some of the islands of the East Indian Archipelago. It was unknown a quarter of a century ago in Bechuanaland, into which it has now been introduced. It is still unknown among the tribes in the far interior of South Africa who have not had intercourse with European settlers. Without entering into the disputed question whether syphilis was endemic in the New World before its discovery by Columbus, it has been established beyond all doubt that there still exist, or did, until quite recently, many tribes in the interior, both of North and South America, who have had little or no intercourse with European settlers, that have enjoyed a complete immunity from the disease,—a fact that to my mind is strong presumptive evidence that syphilis is not indigenous in America.

It is impossible to discover the original seat of this malady—the country in which it originated, the centre from which it spread. Syphilis has certainly been known from remote antiquity in India, China, and Japan, but it is possible that it may have also been endemic in Europe at an equally remote period. Many considerations, however, into which I cannot enter, incline me to look to Eastern Asia as the original habitat of the disease.

Syphilis does not appear to be influenced by *climate*; it has thus, properly speaking, no geographical distribution. It is endemic alike in the cold regions of Kamtschatka and Siberia, and the tropical regions of East Africa and India. Nor has *altitude* any influence on its prevalence, although some have maintained that it is specially prevalent and severe at high altitudes. It is true that it prevails to a large extent in some elevated regions, such as Abyssinia, Central Madagascar, and the table-land of Mexico; but it is certainly no less severe in Zanzibar and on the coasts of Brazil and Chili.

No *race* enjoys an immunity from the malady, except in so far as they have been preserved from intercourse with infected nationalities. It will be admitted that the Indian tribes in the United States, respecting which we have definite statistical information, suffer out of all proportion to the white and negro races. In the same way the aborigines of Australia are being decimated, if not gradually destroyed, by the disease. Yet this may be the result of special social conditions, or of the circumstance of its recent introduction amongst them, rather than to any race peculiarities. We should not forget that, during the great fifteenth century epidemy, the disease proved itself as fatal to Europeans as it now does to the Indian tribes of America, or to the aborigines of Australia. Livingstone thought that syphilis in any form was incapable of permanence in the pure African race in the centre of the continent, as, for example, among the Bechuanas; but subsequent experience has proved that, when subjected to the permanent presence among them of a community suffering from the disease, and little subject to moral restraint, their supposed race immunity has vanished. An immunity from syphilis has also been claimed for the Icelanders and the aborigines of Greenland; but their freedom from the disease has probably nothing to do either with race or climate.

As regards Iceland, we are the less warranted in ascribing the absence of syphilis from that island either to race or climate, that the disease is abundantly prevalent among the same race in Norway, where the climate is not very different. The absence of prostitution among a simple and religious people is a sufficient explanation of the almost complete absence of syphilis from Icelandic pathology.

If we are unable to explain why the Greenlanders have remained free from the disease, notwithstanding the frequent visits of American and English whalers, and the existence of prostitution, we may be quite sure that if we knew sufficiently all the circumstances connected with the visitors, and the social habits of the natives, that it would be found that neither climate nor race is the cause of this immunity. The Eskimo of Alaska and of the Aleutian Islands, branches of the same race, suffer largely from the disease. We are thus of opinion that climate and race have no influence on the spread of the disease, except so far as race involves social habits that may tend either to favour or restrict its prevalence.

Syphilis exists in two forms: the one propagated by sexual intercourse and heredity, and only exceptionally by the inoculation of secondary manifestations; the other, in which the usual mode of its propagation is not by sexual intercourse, but by inoculation from condylomatous patches. This latter form is sometimes spoken of as endemic syphilis, although it seems to have been the most common form in the great epidemy of the fifteenth century.

In relation to these two forms we find a corresponding distribution of the disease. The ordinary form of syphilis is prevalent in proportion as prostitution and other forms of immorality prevail. Consequently, seaports and garrison towns, gold mining districts and pilgrim resorts, where large bodies of unmarried men are in the habit of congregating, are the places most subject to it. The endemic form, on the other hand, may prevail in rural and sparsely peopled localities, where fastidious cleanliness is neglected, where members of large families occupy the same bed, wear the same clothes, use the same spoons and dishes without being washed. It was in such communities that the Sibbens of Scotland and the endemic syphilis of Lithuania prevailed. The opinion that the syphilitic infection always and everywhere, except when inherited, begins, after an incubation period of a fortnight or more, as an indurated sore or papule, infecting the glands, and then showing itself in so-called secondary manifestations, such as condylomata, is so generally accepted, that I scarcely venture to do more than affirm that I have rarely, if ever, been able to trace the existence of an indurated sore in the endemic form. I do not say that it does not exist, but I have sought for it in many cases, and have not found it; and I think that the evolution of the disease in the endemic form deserves to be studied apart from all theories derived from that of the other form of the disease.

Charbon and *Malignant Pustule* are common amongst the workmen engaged in preparing hides for exportation.

Goitre is endemic in some of the Andine districts of the Argentine Republic, and also in the provinces of Corrientes and Entre Rios; and *Cretinism*, according to Poeppig, is met with in Mendoza and San Juan.

Leprosy occurs in Paraguay, and in the northern parts of the Argentine Republic, especially throughout the provinces of Entre Rios and Salta; but it appears to be rare, if not altogether unknown, in the south.

Scrofula is of rare occurrence on the littoral of these States, but Poeppig found it to be common in the inland Argentine provinces of Mendoza and San Juan. Here, as in many other regions, scrofula and phthisis are found to differ so greatly in their distribution, as to warrant the inference that they arise under widely different etiological conditions.

THE FALKLAND ISLANDS.

GEOGRAPHY AND CLIMATE.—The Falkland Islands lie between 51° and 53° S. lat., and between 57° and 62° W. long., about 300 miles off the south-east coast of South America, having a total area of about 5000 square miles, and a population of 1500.

East and West Falkland, the two largest islands of the group, are hilly in the north, sloping to the south, where they form extensive treeless, grassy plains. The highest point in the group attains an elevation of 2315 feet. The soil is peat, resting on yellow clay.

The temperature in winter ranges from 26° to 45° F., and from 50° to 75° in summer. The air is humid, the sky cloudy, and the want of sunshine prevents the ripening of cereals. Sheep-farming is the principal industry. The capital is Stanley, in East Falkland.

PATHOLOGY.—The Colony is remarkably healthy,—the death-rate in 1889 was only 15 per 1000.

Malaria is absent from the group.

Enteric Fever is endemic, and gives rise to a considerable mortality.

Whooping Cough, introduced into Stanley from Punta Arenas in 1890, attacked adults as well as children, and proved very fatal to the young.

Phthisis is extremely rare, and those who have contracted the disease elsewhere improve by a residence in these islands.

Pneumonia, and the *Broncho-Pneumonia* of children, are scarcely known. The colonial surgeon did not meet with a single case either of Pneumonia or of *Acute Rheumatism* during a practice of two years;[1] and the absence of these diseases is all the more remarkable that the inhabitants are constantly exposed to the vicissitudes of a moist climate—"getting wet through and hardly ever changing their clothes."

Chronic Rheumatism and *Muscular Rheumatism* are common, and very intractable.

Chronic Indigestion among the adults, in the form of heartburn or "water-brash," is the bane of these islands, and is ascribed to the enormous quantities of coffee and tea consumed, to the indigestible quality of the bread used, and to the ignorance of the women of the most elementary principles of cookery.

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[1] *Falkland Islands, Blue Book for* 1889.

INDEX.

GENERAL INDEX.

PAGE

Aborigines, diseases of, in
,, Alaska, 788–90
,, Australia, 562–565
,, Canada, 797
,, Guiana, 934
,, New Zealand, 573
,, Tasmania, 568
,, United States, 873
Aleppo Boil, endemic in
,, Algeria, 595
,, Crete, 241
,, Cyprus, 270
,, Mesopotamia, 281
,, Persia, 296
,, Syria, 277
Alpenstich—
,, Switzerland, 189
,, Peru, 970–971
Anæmia, prevalence of, in
,, Borneo (North), 535
,, Brazil, 943
,, Guiana, 933
,, Jamaica, 905
,, Malayan Peninsula, 489
,, Senegal, 613
,, Surinam, 936
,, rapidly induced in malarial epidemics, 111, 348, 534, 750, 756, 939
,, rare in Australia, 561
Anæmic Dropsy (Acute)—
,, India, 466
,, Mauritius, 781
Anchylostoma Duodenale—
,, Borneo, 535
,, Ceylon, 476
,, Guiana (British), 934
,, ,, (French), 939

Belegh, endemic syphilis of Arabia, 284
Bell's description of "fainting ague" of Persia, 294
Beriberi, prevalence of, in
,, Banca, 528
,, Billiton, 528
,, Borneo, 531, 535

PAGE

Beriberi, prevalence of, in
,, Brazil, 964
,, Cayenne, 939
,, China, 512
,, Congo, 649
,, Corea, 256
,, Diego Suarez, 720
,, Gold Coast, 634
,, India, 465
,, Japan, 524
,, Java, 540
,, Malayan Peninsula, 489
,, New Guinea, 547
,, Sumatra, 527
,, Tonkin, 500
,, seasonal prevalence of, in
,, India, 466
,, Japan, 524
Bilious Melanuric (Hæmaturic, Hæmoglobinuric, Blackwater) Fever, prevalence of, in
,, Congo, 648
,, Cuba, 896
,, Gold Coast, 629
,, Guadeloupe, 918
,, India, 319, 359
,, Madagascar, 714, 715
,, Martinique, 919
,, Soudan (French), 638
,, United States, 827
Bilious Remittent, prevalence of, in
,, Africa (E. Coast), 673
,, China, 506, 508
,, Cochin China, 492
,, Congo, 648
,, Cuba, 896
,, Gold Coast, 629
,, Guadeloupe, 915
,, India, 318
,, Java, 538
,, Madagascar, 714
,, Paraguay, 980
,, Peru, 969
,, Sierra Leone, 624
,, Sumatra, 526
,, Tonkin, 496, 497
,, United States, 829

PAGE
Bilious Typhoid—
,, Afghanistan, . . 298
,, Asia Minor, . . 273
,, Egypt, . . . 603
Boat Cough, form of influenza in St. Kilda, ... 140
Bombay Fever, of Mauritius, . . 738
Bright's Disease, prevalence of, in
,, Guiana, . . 934
Bronchitis, distribution of, in
,, England, . . . 132
,, France, . . . 180
,, Germany, . . . 89
,, India, . . . 452
,, Norway, . . . 23
,, United States, . . 859
,, effects of occupation on prevalence of, . 132, 188
,, prevalent in
,, Algeria, . . . 594
,, Argentine Republic, . 983
,, Canary Islands, . . 704
,, Cape Verde Islands, . 706
,, China (North), . . 511
,, England, . . . 131
,, Germany (East), . 89
,, Scotland, . . . 140
,, Spain, . . . 203
,, rare in
,, Bechuanaland, . . 663
,, Cape, . . . 656
,, Ceylon, . . . 476
,, Fiji, ... 575
,, Guiana, . . . 932
,, Java, . . . 539
,, Malayan Peninsula, . 489
,, Mauritius, . . . 781
,, Natal, . . . 659
,, Seychelles, . . 723
,, relation of—
,, to chill, . . . 23
,, to density of population, . 132, 188, 860
,, to occupation, . 23, 132
,, seasonal distribution of, in
,, Australia, . . . 559
,, England and Wales, . 132
,, India, . . . 454
,, Italy, . . . 234
,, New Zealand, . . 571
,, United States, . . 860

Cancer, distribution of, in
,, England and Wales, . 133
,, Germany, . . . 89
,, Italy, ... 234
,, Norway, ... 25
,, United States, . . 872
,, prevalence of, in
,, Abyssinia, . . . 697
,, Australia, . . . 561
,, Austria, ... 102
,, Belgium, . . . 159
,, Canada, ... 796
,, England, . . . 133

PAGE
Cancer, prevalence of, in
,, Germany, . . . 89
,, Italy, ... 234
,, Netherlands, . . . 156
,, New Zealand, . . 572
,, Norway, . . . 25
,, Scotland, . . . 140
,, Sweden, ... 41
,, Switzerland, . . . 190
,, Tasmania, . . . 568
,, United States, . . 872
,, rare in
,, Africa (East Central), . 694
,, Arabia (plateau), . . 284
,, Bechuanaland, . . 664
,, Faröe Islands, . . 13
,, Gold Coast, . . . 634
,, Guiana, ... 934
,, Iceland, ... 10
,, India, ... 465
,, Jamaica, . . . 910
,, Mauritius, . . . 781
,, New Caledonia, . . 576
,, Persia, ... 296
Caribi, gangrenous rectitis of Guiana, 935
Chlorosis, increase of, in Sweden, . 41
Cholera (Asiatic), countries that have escaped—[1]
,, Australia, . . 557
,, Bermudas, . 894
,, Cape, Natal and Zululand, . 655
,, Chili, . . 975
,, Falkland Islands, 987
,, Faröe Islands, . 12
,, Kamtschatka and North Siberia, . . 250
,, Madagascar, . 719
,, Russia (north of 64°), . . 56
,, cyclical manifestations of, . 441
,, diffused by human intercourse, 83, 428, 434, 475, 523, 593, 603, 702, 780, 844, 885, 937, 982
,, disseminated by
,, Fomites, . . 435
,, Food, . . 427
,, Water, . 425, 427
,, distribution of, in
,, India, . . 419
,, epidemies of, in
,, Abyssinia, . 696
,, Afghanistan, . 298
,, Africa (East), . 688
,, Algeria, . . 593
,, Andaman Islands, 479

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[1] To these may be added the Hebrides, Shetland and Orkney Islands, the West Coast of Africa, from Sierra Leone southwards; St. Helena, Ascension; America, North of Canada and South of Argentina.

PAGE
Cholera (Asiatic), epidemics of, in
,, Arabia, . . 284
,, Argentina, . 982
,, Asia Minor, . 273
,, Austro-Hungary, 99
,, Banjar-Masin, . 532
,, Bolivia, . . 982
,, Brazil, . . 961
,, Canada, . . 795
,, Canary Islands, 704
,, Cape Verde Islands, . . 706
,, Ceylon, . . 475
,, China, . . 509
,, Cochin China, . 492
,, Comoro, . . 711
,, Cuba, . . 900
,, Egypt, . . 603
,, England, . . 119
,, France, . . 179
,, Germany, . . 83
,, Honduras, . 885
,, India, . . 418
,, Italy, . . 232
,, Jamaica, . . 908
,, Japan, . . 522
,, Java, . . 539
,, Madeira, . . 702
,, Mesopotamia, . 280
,, Morocco, . . 587
,, Norway, . . 19
,, Paraguay, . 982
,, Persia, . . 296
,, Peru, . . 982
,, Philippine Islands, 545
,, Russia, 53, 56, 59, 64
,, Senegal, . . 619
,, Siam, . . 491
,, Siberia, . . 250
,, Spain, . . 202
,, Sumatra, . . 526
,, Sumbawa Group, . 543
,, Surinam, . . 937
,, Sweden, . . 38
,, Tonkin, . . 499
,, Tunis, . . 597
,, United States, . 844
,, Uruguay, . . 982
,, general review and summary, . 418–441
,, predisposing causes, 438
,, race proclivities, 419, 439, 844
,, relation to intermittent fever, . 74
,, seasonal prevalence of, in India, 436, 437
,, towns or districts in Belgium that have almost or entirely escaped, 158
,, in France—Lyons, Rouen, Sedan, Versailles, Vosges, . . 179

PAGE
Cholera Nostras, 6, 12, 18, 82, 119, 155, 177, 296, 557, 567, 577, 579, 788, 844
,, relation to
,, Density of population, 82, 119, 845
,, Temperature, 82, 119, 845
Choreamania, epidemic of, in Madagascar, ... 721
Cold Plague, algid congestive fever, 828
Colic in Congo region, . . . 648
,, in West Indies, . . . 920
Convulsions—
,, Australia, . . . 561
,, Ceylon, . . . 477
,, Hong-Kong, . . 519
,, Jamaica, . . . 910
,, New Zealand, . . 572
,, United States, . . 871
Cretinism, distribution of—*see* Goitre.
,, relation to Goitre, . . 190
Croup—*see* also Diphtheria.
,, prevalence of, in
,, Australia, . . . 556
,, England, . . . 133
,, Finland, . . . 48
,, Iceland, ... 6
,, Netherlands, . . . 154
,, New Zealand, . . 571
,, Norway, . . . 18
,, Russia, . . . 56, 60
,, Scotland, . . . 140
,, Sweden, ... 35
,, Trinidad, . . . 924
,, United States, . . 842

DENGUE, Africa (East), . . . 692
,, Bermudas, . . . 894
,, China, ... 510
,, India, ... 412
,, Java, ... 539
,, Mauritius, . . . 780
,, Zanzibar, ... 710
Diabetes—
,, Australia, . . . 561
,, Ceylon, ... 477
,, Denmark, . . . 45
,, England, ... 133
,, Germany, . . . 90
,, India, ... 465
,, Ireland, . . . 144
,, Jamaica, ... 910
,, Madagascar, . . . 720
,, New Zealand, . . . 572
,, Norway, ... 25
,, Scotland, ... 140
Diarrhœa, geographical distribution of, in
,, Canada, . . . 794
,, France, . . . 178
,, Germany, . . . 81
,, Italy, ... 232
,, Netherlands, . . . 154

PAGE
Diarrhœa, geographical distribution of, in
,, Norway, 18
,, Sweden, 38
,, hill, in India, 415
,, increase of, in England (1841–65), 120
,, intermittent, 505
,, prevalence of, in
,, Australia, 557
,, Austro-Hungary, 99
,, Berlin, 82
,, Canary Islands, 704
,, China, 509
,, Denmark, 44
,, England, 119
,, France, 177
,, Germany, 81
,, India, 413
,, Italy, 231
,, Jamaica, 905
,, Java, 539
,, Malayan Peninsula, 489
,, Moscow, 59
,, Netherlands, 154
,, New Zealand, 571
,, Russia, 59
,, Siam, 491
,, Sweden, 38
,, United States, 844
,, Warsaw, 59
,, relation to
,, density of population, 82, 119, 178
,, temperature, 119, 554
,, seasonal prevalence of, in
,, Australia, 557
,, England, 119
,, Germany, 82
,, India, 417
,, New Zealand, 571
,, Norway, 19
,, Sweden, 38
,, United States, 845
Diphtheria, geographical distribution of, in
,, Australia, 556
,, England, 118
,, France, 176
,, Germany, 80
,, Italy, 231
,, Netherlands, 154
,, United States, 843
,, introduced into
,, Faroe Islands, 12
,, Iceland, 5
,, Moscow, 60
,, Podolia, 64
,, Transylvania, 98
,, Vienna, 98
,, prevalence of, in
,, Africa (East Central), 687
,, ,, (East Coast), 673
,, Algeria, 593
,, Australia, 557
,, Austro-Hungary, 98

PAGE
Diphtheria, prevalence of, in
,, Bechuanaland, 663
,, Brazil, 946
,, Canada, 794
,, Cape, 655
,, China, 510
,, Cochin China, 492
,, Cuba, 901
,, Denmark, 44
,, England, 118
,, Greece, 240
,, Honolulu, 578
,, India, 442
,, Japan, 522
,, Mauritius, 780
,, Natal, 659
,, New Caledonia, 576
,, New Zealand, 571
,, Peru, 969
,, Roumania, 245
,, St. Helena, 707
,, Smyrna, 273
,, Spain, 202
,, Sweden, 35
,, Switzerland, 185
,, Tasmania, 567
,, Teheran, 295
,, Tunis, 597
,, United States, 842
,, unknown in
,, Fiji, 574
,, Madagascar, 719
,, Senegal, 619
,, Seychelles, 722
Dropsy (Acute Anæmic), 466, 781
,, (Epidemic), 694
,, prevalent in
,, Borneo, 535
,, Cayenne, 939
,, Ceylon, 476
,, India, 460
,, Malayan Peninsula, 489
,, Surinam, 936
Dysentery, endemic or epidemic, in
,, Abyssinia, 697
,, Afghanistan, 299
,, Africa (East Central), 688
,, Arabia (Coasts), 284, 287
,, Asia Minor, 273
,, Bagdad, 280
,, Borneo (North), 535
,, Brazil, 962
,, Burma, 482
,, Cape, 655
,, Cayenne, 939
,, Ceylon, 474
,, Chili, 975
,, China, 509
,, Cochin China, 492
,, Comoro, 711
,, Cuba, 900
,, Egypt, 603
,, Fiji, 575
,, France, 178
,, Gaboon, 640

PAGE
Dysentery, endemic or epidemic, in
,, Grand Bassam, . . 626
,, Greece, . . . 240
,, Guadeloupe, . . 918
,, Guayaquil, . . 966
,, Guiana, . . . 931
,, Haiti, . . . 911
,, Hong-Kong, . . 518
,, India, . . . 413
,, Italy, . . . 231
,, Jamaica, . . . 909
,, Japan, . . . 522
,, Java, . . . 539
,, Leeward Group, . 921
,, Madagascar, . . 719
,, Martinique, . . 919
,, Mauritius, . . 780
,, Mexico, . . 880, 881
,, Natal, . . . 659
,, Panama, . . . 889
,, Peru (Coasts), . . 970
,, ,, (Sierra), . . 971
,, Philippines, . . 545
,, Roumania, . . 245
,, Russia, . 53, 56, 59, 64
,, St. Helena, . . 707
,, San Nicolas, . . 706
,, Senegal, . . . 619
,, Seychelles, . . 722
,, Sierra Leone, . . 625
,, Soudan (French), . 639
,, Sumatra, . . . 527
,, Surinam, . . . 937
,, Trinidad, . . . 924
,, Tunis, . . . 597
,, United States, . . 845
,, Queensland, . . 557
,, epidemies of, in
,, Brazil, . . . 962
,, France, . . . 178
,, Madeira, . . . 703
,, Norway, . . . 18
,, Sweden, . . . 36
,, Wurtemberg, . . 83
,, etiology of, in Africa, 689–691
,, geographical distribution of, in
,, Jamaica, . . . 909
,, Mexico, . . 880, 881
,, United States, . . 845
,, in some malarious districts of Italy, . 232
,, in the Malayan Peninsula, 489
,, Netherlands, . . 154
,, Pernambuco, . . 962
,, Sahara, . . . 607
,, Switzerland, . . 189
,, Tasmania, . . . 567
,, rare in
,, Banjar-Masin, . . 532
,, Dittmarschen, . . 83
,, Gold Coast, . . 634
,, Greenland, . . 788
,, seasonal prevalence of, in
,, Algeria, . . . 593
,, Australia, . . . 557

PAGE
Dysentery, seasonal prevalence of, in
,, Finland, . . . 48
,, India, . . . 416
,, Senegal, . . . 620
,, Sweden, . . . 38
,, United States, . . 846
,, spread of, by troops, . 59

Él Bicho (gangrenous rectitis), Brazil, 962
Elephantiasis, endemic in
,, Barbadoes, . . 922
,, Borneo, . . 532
,, China, . . . 512
,, Fiji, . . . 575
,, Gold Coast, . . 634
,, Guiana, . . 934
,, New Guinea, . 547
,, Philippines, . . 546
,, Zanzibar, . . 710
,, introduced into Surinam, 937
Enteritis, mortality from, in
,, Australia, . . . 557
,, England and Scotland, 139
Erysipelas, distribution of, in
,, Germany, . . . 85
,, United States, . . 841
,, mortality from, in
,, Australia, . . . 556
,, England, . . . 119
,, India, . . . 442
,, Italy, . . . 233
,, Switzerland, . . 186
,, United States, . . 841
,, rare in Madagascar, . 719
,, typhoid, in United States, 841

Febris Complicata (Rock Fever), description of, in . . 198
,, Gibraltar, . 198
,, Malta, . . 224
Fever, Continued, of
,, Aden, . . 288
,, Bermuda, . . 893
,, Egypt, . . 603
,, Guiana, . . 931
,, Malta, . . 223
,, United States, . 829
Fever, Enteric, as a miasmatic disease, 115–118, 229, 230, 298, 397–411, 556, 652, 654, 662, 794, 830–834, 840, 881, 945
,, carbuncles in, . . 5
,, endemic in
,, Abyssinia, . . 696
,, Afghanistan, . 298
,, Africa (East Central), 687
,, Albania, . . 237
,, Algeria, . . 593
,, Arabia (Coast), . 283

PAGE
Fever, Enteric, endemic in
,, Argentina, . . 981
,, Australia, . . 553
,, Austro-Hungary, . 97
,, Bermuda, . . 893
,, Brazil, . . . 945
,, Canada, . . 793
,, Cape, . . . 652
,, Cayenne, . . 939
,, Chili, . . . 975
,, China, . . . 508
,, Cochin China, . 492
,, Cuba, . . . 897
,, Denmark, . . 43
,, Egypt, . . . 602
,, England, . . 111
,, Falkland Islands, . 987
,, Finland, . . 47
,, France, . . 172
,, Greece, . . . 240
,, Greenland, . . 788
,, Guadeloupe, . . 918
,, Guiana (British), 931
,, Iceland, . . 32
,, India, . . 397–411
,, Ireland, . . 142
,, Italy, . . . 228
,, Jamaica, . . 908
,, Japan, . . 521
,, Java, . . . 538
,, Labrador, . . 788
,, Madagascar, . . 718
,, Madeira, . . 702
,, Mauritius, . . 780
,, Mexico, . . 881
,, Morocco, . . 587
,, Natal, . . . 659
,, Netherlands, . 152
,, New Caledonia, . 576
,, Newfoundland, . 798
,, New Zealand, . 570
,, Paraguay, . . 981
,, Puerto Rico, . . 912
,, Russia, 52, 55, 59, 63
,, St. Helena, . . 707
,, Sandwich Islands, 578
,, Sitka, . . . 788
,, Society Islands, . 577
,, Spain, . . . 201
,, Surinam, . . 936
,, Sweden, . . 32
,, Switzerland, . . 184
,, Tasmania, . . 566
,, Teheran, . . 295
,, Tonkin, . . 489
,, Transvaal, . . 660
,, Trinidad, . . 924
,, Tunis, . . . 597
,, United States, . 838
,, Uruguay, . . 981
,, geographical distribution of, in
,, Africa (Central) . 687
,, Australia, . . 553
,, England, . . 114
,, France, . . 174

PAGE
Fever, Enteric, geographical distribution of, in
,, India, . . . 397
,, Italy, . . . 229
,, Netherlands, . 153
,, United States, . 839
,, peculiar exanthems in, 654
,, rare in
,, Africa (East Coast), 673
,, Bechuanaland, . 662
,, Gaboon, . . 640
,, Gold Coast, . . 634
,, Guiana, . . 931
,, Honduras, . . 885
,, Nejid, . . . 283
,, Senegal, . . 619
,, Sierra Leone, . 625
,, Singapore, . . 489
,, Surinam, . . 936
,, Trinidad, . . 924
,, Zanzibar, . . 709
,, relation to—
acclimatisation, 399, 593, 933
,, age, . . 399, 838
,, altitude, . 185, 840
,, density of population, 77, 114, 474, 652, 838, 908
,, latitude, 17, 33, 75, 174, 229, 553, 838
,, malaria, 231, 405, 409, 553, 834, 836
,, race, 397, 838, 873, 931
,, seasonal prevalence of, in
,, Abyssinia, . . 696
,, Australia, . . 554
,, England, . 112, 113
,, Finland, . . 47
,, France, . . 175
,, Germany, . 77, 79
,, India, . . . 398
,, Italy, . . . 230
,, Netherlands, . 153
,, Norway, . . 17
,, Prague, . . 98
,, Scotland, . . 138
,, Sweden, . . 33
,, Switzerland, . . 185
,, United States, . 840
,, sore throat, in 401, 653, 833
Fever, Fainting, of Persia, description of, ... 294
Fog, of Australia, ... 958
,, Malarial—*see* Malaria.
,, Miliary, . . . 179, 231
,, Mountain, in United States, . 831
Fever, Relapsing, in
,, Algeria, ... 593
,, Austro-Hungary, . . 98
,, China, ... 509
,, Cyprus, ... 265
,, Egypt, ... 603
,, England, ... 118

PAGE
Fever, Relapsing, in
,, Germany, 79
,, India, 411
,, Ireland, 142
,, Mauritius, 738, 780
,, Morocco, 587
,, Norway, 17
,, Russia, 53, 59, 63
,, Scotland, 138
,, Siberia, 250
,, Sweden, 34
,, United States, 841
Fever, River, in Japan, 522
,, Rock, description of, 198
Fever, Typhus, in
,, Algeria, 593
,, Austro-Hungary, 98
,, Balkan Peninsula, 244
,, Celebes, 543
,, Chili, 975
,, China, 509
,, England, 121
,, France, 179
,, Germany, 79
,, Hong-Kong, 518
,, Ireland, 142
,, Italy, 231
,, Nicaragua, 888
,, Norway, 17
,, Russia, 52, 56, 59, 63
,, Scotland, 139
,, Spain, 201
,, Sweden, 34
,, Turkestan, 280
Fever, Yellow, in
,, Argentina, 981
,, Ascension, 707
,, Bahamas, 895
,, Bermuda, 894
,, Brazil, 946
,, Canada, 794
,, Canaries, 704
,, Cape Verde Islands, 705
,, Cayenne, 939
,, Colombia, 927
,, Cuba, 897
,, Grand Bassam, 626
,, Guadeloupe, 918
,, Guayaquil, 966
,, Guiana, 931
,, Haiti, 911
,, Jamaica, 908
,, Leeward Group, 921
,, Majorca, 205
,, Martinique, 919
,, New Orleans, 837
,, Paraguay, 981
,, Peru, 969
,, Puerto Rico, 912
,, Senegal, 619
,, Sierra Leone, 624
,, Spain, 201
,, Surinam, 936
,, Trinidad, 924
,, Uruguay, 981
,, Venezuela, 928

PAGE
Fever, Yellow, in
,, Windward Group, 921
,, relation to altitude in Mexico, 879, 880
,, seasonal prevalence in New Orleans, 838
,, summary and review of facts concerning, 897–900
Frambœsia, description of, 635
,, notices of, 477, 528, 529, 540, 544, 575, 577, 625, 650, 873, 910, 925, 937
,, supposed to prevent leprosy, 544
,, to improve the health, 575

Gangrenous Rectitis, Brazil, 962
,, Fiji, 575
,, Guiana, 935
Goitre, endemic in
,, Africa (East Coast), 676
,, ,, (Lake Region), 693
,, Algeria, 595
,, Argentina, 987
,, Armenia, 274
,, Austro-Hungary, 102
,, Azores, 701
,, Canada, 790
,, Caucasus, 64
,, Chili (Cordilleran Region), 976
,, China, 512
,, Colombia, 927
,, Guatemala, 887
,, India, 465
,, Italy, 235
,, Java, 540
,, Khokan, 254
,, Ladoga (Lake), 56
,, Mexico, 881
,, Moldavia and Wallachia, 246
,, Paraguay, 987
,, Peru, 971
,, Russia, 61
,, Siberia, 252
,, Spain, 205
,, Sumatra, 527
,, Sweden, 41
,, Switzerland, 190
,, United States, 873
,, Venezuela, 928
,, Yarkand, 254
Grosseto, description of the commune of, 209
Guadeloupe, fevers of, 913

Hati-wiri, chloro-anæmia of Surinam, 936
Heart Diseases, mortality from, in
,, Australia, 561
,, England, 133
,, Switzerland, 189
,, United States, 871
Hepatitis, in
,, Africa (Coast), 676

PAGE
Hepatitis, in
,, Africa (East Central), 692
,, Algeria, 595
,, Banca, 528
,, Cape Verde Islands, 706
,, China, 511
,, Cochin China, 492
,, Cuba, 901
,, Egypt, 604
,, Fernando Po, 706
,, Greece, 241
,, Guayaquil, 966
,, Guiana, 933
,, Hong-Kong, 519
,, India, 455
,, Italy, 234
,, Jamaica, 910
,, Japan, 523
,, Java, 539
,, Mexico, 880
,, New Caledonia, 576
,, Philippine Islands, 546
,, Riouw Archipelago, 529
,, St. Helena, 708
,, Sandwich Islands, 579
,, San Salvador, 887
,, Senegal, 620
,, Society Islands, 578
,, Soudan, 639
,, Spain, 204
,, Sumatra, 527
,, Trinidad, 925
,, Tunis, 597
,, Valparaiso, 976
,, children, 457
,, relation to malaria, 234
Hydatid Disease, in
,, Australia, 562
,, Iceland, 10
,, New Zealand, 572
,, Tasmania, 568
Hydrocephalus, geographical distribution of, in England, 134
Hydrophobia, in
,, England, 135
,, Tibet, 513
Hysteria, Iceland, 13

Influenza, epidemies of, in
,, Aleutian Islands, 789
,, Australia, 556
,, Brazil, 946
,, China, 510
,, England, 125
,, Faröe Islands, 12
,, Fiji, 575
,, Germany, 85
,, Greenland, 789
,, Iceland, 7
,, India, 412
,, Madeira, 703
,, St. Kilda, 140
,, Samoan Islands, 577
,, Siberia, 250
,, Society Islands, 577

PAGE
Influenza, epidemies of, in
,, Tasmania, 567
,, United States, 841
,, summary and review of the forms and characters of, 946–961
Insanity—
,, Africa (East Central), 694
,, Iceland, 13
Itch, unknown in British New Guinea, 547

Jungle Fever, description of, 318
Jur Beekar, form of malarial fever, 365

Kim Chokie, or red-tongue fever, 378

Leprosy, endemic in
,, Abyssinia, 697
,, Africa (East Central), 693
,, ,, (East Coast), 676
,, Algeria, 595
,, Argentina, 987
,, Asia Minor, 274
,, Australia, 562
,, Azores, 701
,, Bahamas, 895
,, Borneo, 532
,, Brazil, 964
,, Canary Islands, 705
,, Cape, 657
,, Cape Breton, 796
,, Cayenne, 939
,, Ceylon, 477
,, China, 511
,, Congo, 649
,, Corea, 256
,, Crete, 241
,, Cuba, 901
,, Cyprus, 270
,, Egypt, 604
,, France, 181
,, Gold Coast, 634
,, Guiana, 934
,, Hong-Kong, 519
,, India, 462–464
,, Italy, 235
,, Jamaica, 910
,, Japan, 524
,, Java, 540
,, Leeward Group, 922
,, Madagascar, 720
,, Madeira, 703
,, Marquesas Islands, 580
,, Mauritius, 78
,, Morocco, 587
,, New Guinea, 547
,, New Brunswick, 796
,, New Zealand, 573
,, Norway, 25
,, Paraguay, 987
,, Persia, 296
,, Peru, 970

PAGE

Leprosy, endemic in
,, Philippine Islands, . 546
,, Riouw Archipelago, . 529
,, Russia, . . . 54, 64
,, St. Helena, . . . 708
,, Senegal, . . . 620
,, Seychelles, . . . 723
,, Siam, ... 491
,, Sierra Leone, . . 625
,, Spain, ... 205
,, Sumatra, . . . 527
,, Surinam, . . . 937
,, Sweden, . . . 41
,, Tibet, ... 513
,, Tonkin, . . . 500
,, Transvaal, . . . 660
,, Trinidad, . . . 925
,, Tunis, ... 597
,, United States, . . 873
,, Windward Group, . . 922
,, epidemic spread of, in Sandwich Islands, . 579
Liver and Spleen, diseases of, mortality from, in England, . . 133
Lymphangitis, in
,, Brazil, . . . 963
,, Réunion, . . . 784
,, Trinidad, . . . 925

Malaria, effect of epidemic influences on, 327–332, 341, 347, 349–355
,, geographical distribution of, in
,, Abyssinia, . . . 696
,, Afghanistan, . . . 298
,, Africa (East Central), . 676
,, ,, (East Coast), . 671
,, Albania, . . . 237
,, Algeria, ... 589
,, Amboyna, . . . 543
,, Anatolia, . . . 272
,, Arabia, ... 283
,, Argentina, . . . 979
,, Austro-Hungary, . . 93
,, Bengal, ... 360
,, Bima, ... 542
,, Bolivia, ... 972
,, Brazil, . . . 942–945
,, Burma, ... 481
,, Canada, ... 793
,, Cape Verde Islands, . 705
,, Cayenne, . . . 938
,, Celebes, ... 543
,, Central Provinces, . . 386
,, Ceylon, ... 470
,, Chili, ... 974
,, China, ... 504
,, Colombia, . . . 926
,, Comoro Islands, . . 711
,, Congo, ... 644
,, Corsica, ... 223
,, Deccan (Western), . . 391
,, Egypt, ... 600
,, England, . . . 107

PAGE

Malaria, geographical distribution of, in
,, France, ... 162
,, Germany, . . . 69
,, Greece, ... 239
,, Guadeloupe, . . . 913
,, Guiana, ... 929
,, Hayti, ... 911
,, India, . . . 313–315
,, Indus Valley, . . 373
,, Italy, ... 215
,, Jamaica, . . . 903
,, Japan, ... 521
,, Java, ... 537
,, Kutch and Gujarât, . 377
,, Madagascar, . . . 713
,, Martinique, . . . 919
,, Mauritius, . . . 758
,, Mesopotamia, . . 279
,, Mexico, . . . 877, 880
,, Mysore, ... 393
,, Muscat, ... 290
,, Netherlands, . . . 147
,, New Guinea, . . . 547
,, North-Western Provinces, 356
,, Paraguay, . . . 979
,, Peru, . . 968, 970, 971
,, Philippine Islands, . 545
,, Punjab, ... 334
,, Roumania and Roumelia, 243
,, Sahara, ... 606
,, Sardinia, . . . 222
,, Senegal, . . . 613
,, Servia, ... 243
,, Sierra Leone, . . . 623
,, Spain, ... 195
,, Sumatra, . . . 526
,, Surinam, . . . 936
,, Sweden, . . . 28
,, Switzerland, . . . 183
,, Syria, ... 275
,, Tenimber Islands, . . 543
,, Timor, ... 543
,, Trinidad, . . . 923
,, Tunis, ... 596
,, United States, . 808–837
,, Uruguay, . . . 979
,, Venezuela, . . . 928
,, in dry regions, 197, 220, 367, 704
,, influence of altitude on, in
,, Germany, . . . 71
,, India, ... 540
,, Italy, ... 224
,, Jamaica, . . . 904
,, Mauritius, . . . 758
,, Persia, ... 294
,, Punjab, ... 341
,, United States, . . 821
,, influence of disturbance of soil on prevalence of, 71, 108, 163, 171, 272, 473, 488, 515, 534, 542, 938, 945, 981
,, influence of humidity of soil on prevalence of, 29, 73, 94, 164, 165,

PAGE
Malaria, influence of humidity of soil on prevalence of, 166, 169, 239, 337, 357, 358, 590, 601, 606, 607, 684, 822–826, 905
,, influence of inundations on prevalence of, 58, 72, 95, 171, 198, 279, 336, 337, 339, 372, 374, 753, 823, 942
,, influence of irrigation on, 336, 356
,, relation to underground depressions, 95, 368, 369, 606, 681, 684
Malarial Cachexia, in
,, Cayenne, . . 938
,, Cuba, . . 897
,, India, 336, 354, 378, 384, 388
,, Italy, . . 221
,, La Dombes, . 166
,, Madagascar, . 714
,, Sahara, . . 606
,, Senegal, . . 613
,, Soudan, . 638, 714
,, Sumatra, . . 526
,, Surinam, . . 939
,, United States, . 829
,, primary, 672, 714, 774, 944
Malarial Fever, complications and results—
,, Abortions, 751, 938
,, Cancrum oris, . 505
,, Coryza, . 348, 749
,, Dysentery, . 348
,, Epistaxis, 150, 473, 507, 538, 750, 969
,, Hæmorrhages, 150, 473, 507, 828, 897, 971
,, ,, from rectal veins, 150, 376
,, Herpes, . 911, 938
,, Idiocy, . . 613
,, Jaundice, . . 348
,, Lymphangitis, 293, 714
,, Mania, . . 714
,, Purpura, 111, 150, 171, 267, 359, 908
,, Sore throat, . 348
,, Sterility, . . 543
,, Still-births, 761, 938
,, Tetanus, . . 542
,, Trismus, . . 538
,, Ulceration of the cornea, . . 505
,, Urticaria, . . 938
,, epidemies of, in
,, Amritsar, . . 337
,, Belgium, . . 158

PAGE
Malarial Fever, epidemies of, in
,, Bima, . . 542
,, Brazil, . . 944
,, Burdwan, . . 363
,, Chili, . . 974
,, Cyprus, . 258–269
,, Denmark, . . 43
,, Dhárwar, . . 383
,, England, . . 109
,, France, . . 171
,, Germany, . 73, 74
,, Haiderabad, . 375
,, Hong-Kong, . 515
,, Java, . . 538
,, Madagascar, . 717
,, Mauritius (map), 741–756
,, Netherlands, 150–152
,, North - Western Provinces, 349–352
,, Peru, . . 971
,, Punjab, . 327–348
,, Sweden, . . 32
,, Trinidad, . . 918
,, United States, 834–836
,, Walcheren, . 151
,, endemic manifestations of, in
,, Benty, . . 613
,, Bulama, . . 613
,, Madagascar, . 716
,, Mauritius (map), 758–773
,, United States, 834–836
,, relation to rainfall, 227, 286, 290, 343–346, 349–355, 396, 472, 473, 762–773, 811–820
,, relation to temperature, 110, 167, 225, 226, 347, 395, 590, 762–773, 811–820
,, remittent form in
,, Aden, . . 287
,, Arabia, . . 283
,, Baluchistan, . 297
,, Cyprus, . . 269
,, Malta, . . 224
,, Muscat, . . 290
,, Tonkin, . . 496
,, United States, . 829
,, seasonal prevalence of—*see* under each country.
Maories, diseases of, . . . 573
Measles, not endemic, in
,, Australia, . . . 564
,, Cape, ... 655
,, Faröe Islands, . . 12
,, Greenland, . . . 789
,, Hudson Bay Territory, . 789
,, Iceland, . . . 10
,, Mauritius, . . . 781

PAGE
Measles, not endemic, in
,, St. Helena, 708
,, Tasmania, 567
,, Tierra del Fuego, 975
,, relation to temperature, 123, 125
,, seasonal distribution of, in
,, Berlin, 122
,, London, 122
,, Paris, 122
,, Prague, 100
,, Vienna, 100
Mirra, a boil endemic in Australia, 565
Murri-murri, a form of influenza, 958

NEGRO LETHARGY (sleeping sickness), 625, 650
Ngerengere, endemic leprosy of Maories, 573

OBOK FEVER, description of, 602
Oovi, leprosy of Tahiti, 578
Ophthalmia, in
,, Africa (East Central), 694
,, Arabia, 285
,, Australia (aborigines), 565
,, Bechuanaland), 664
,, Borneo, 532
,, Morocco, 587
,, Syria, 277
,, Tibet, 513
,, common in marshy localities, 664
Oroya Fever, epidemic fever in Peru, 970

PARANGI, disease of Ceylon, 477
Pelade, Columbian maize disease, 927
Pellagra, description of, 234
,, geographical distribution of, in
,, France, 181
,, Italy, 234
,, Moldavia, 246
,, Spain, 205
Peruvian Wart (Veruga), 971
Phthisis, geographical distribution of, in
,, Algeria, 594
,, Argentina, 983
,, Australia, 560
,, Belgium, 159
,, Brazil, 963
,, Canada, 796
,, Cape, 656
,, Chili, 975
,, England, 126
,, France, 181
,, Germany, 86
,, Guiana, 932
,, India, 446
,, Italy, 233

PAGE
Phthisis, geographical distribution of, in
,, Jamaica, 909
,, Mexico, 880, 881
,, Netherlands, 155
,, Norway (map), 19–22
,, Paraguay, 983
,, Peru, 970, 971
,, Sweden, 40
,, United States, 847–859
,, prevalence of—*see* under each country.
,, prevalence of, among aboriginal races in
,, Alaska, 789
,, Aleutian Islands, 789
,, American Indians, 874
,, Australia, 564
,, Guiana, 935
,, rare in
,, Abyssinia, 697
,, Africa (East Coast), 675
,, Andes, 967, 971, 972, 983
,, Arabian plateau, 284
,, Armenian plateau, 273
,, Azores, 701
,, Bechuanaland, 663
,, Beyrouth, 277
,, Bolivia (Sierra), 972
,, Cordilleran region (United States), 851
,, Egypt, 604
,, Falkland Islands, 987
,, Iceland, 10
,, Khiva, 253
,, Loango, 640
,, Malayan Peninsula, 489
,, Morocco, 587
,, Natal, 659
,, Sahara, 607
,, Senegal, 620
,, Siam, 491
,, Sumatra, 527
,, Transvaal, 660
,, Zambesi (Upper), 692
,, relation of,
to altitude, 87, 187, 204, 851, 881, 887, 939
,, to latitude, 40, 86, 181, 560, 849
,, to malaria, 87, 233
,, to race, 847, 874
,, to sex, 126, 847
,, to soil, 40, 127, 850
,, summary of facts bearing on its relation to malaria, 852
,, introduced into Tierra del Fuego, 976
,, unknown in
,, Bolivia (Sierra), 972
,, Kirghiz Steppe, 251
,, Nijhi Kolimsk, 251
,, Quito, 967
Pinta, disease of Mexico, 882
Plague, in
,, Arabia, 283

PAGE
Plague, in
,, Astrakhan, ... 63
,, Balkan Peninsula, . 244
,, Canary Islands, . . 704
,, China, ... 510
,, Egypt, ... 603
,, Iceland, ... 5
,, India, ... 413
,, Mesopotamia, . . 281
,, Persia, ... 295
,, Syria, ... 276
,, seasonal prevalence of, in Alexandria, . . 603
,, supposed existence of, in Uganda, . . . 688
Pleurisy, epidemic in Andine regions of Peru, . . . 971
,, geographical distribution of, in England, . . 131
,, mortality from, in
,, Australia, . . . 560
,, Spain, ... 203
,, United States, . . 871
Plica Polonica, distribution of, . 61
Pneumonia, epidemic in
,, Alaska, . . . 788
,, Guiana, . . . 932
,, Iceland (Taksott), . 10
,, India, . . . 453
,, Norway, . . . 24
,, Peru, . . 970, 971
,, United States, . . 870
,, Vienna, . . . 101
,, prevalence of, in
,, Algeria, . . . 594
,, Andes, . . 971, 983
,, Arabian plateau, . 284
,, Argentina, . . . 983
,, Australia, . . . 559
,, Brazil, . . . 963
,, Canada, . . . 795
,, Canaries, . . . 704
,, Cape, . . . 656
,, Cape Verde Islands, . 706
,, Cayenne, . . . 939
,, Chili, . . . 976
,, Congo, . . . 649
,, Denmark, . . . 44
,, England, . . . 129
,, Fiji, ... 575
,, France, . . . 180
,, Germany, . . . 88
,, Guiana, . . . 932
,, India, . . . 452
,, Jamaica, . . . 909
,, Loango, . . . 640
,, Madagascar, . . 719
,, Madeira, . . . 703
,, Mexico, . . . 881
,, Norway, . . . 24
,, Paraguay, . . . 983
,, Peru, . . 970, 971
,, Sitka, . . . 788
,, Spain, . . . 203
,, Switzerland, . . 188
,, Syria, . . . 277

PAGE
Pneumonia, prevalence of, in
,, United States, . . 860
,, Uruguay, . . . 983
,, Valparaiso, . . 976
,, rare in
,, Abyssinia, . . 697
,, Africa (East Central), 692
,, Arabian Coasts, . 284
,, Bechuanaland, . . 663
,, Beyrouth, . . 277
,, Falkland Islands, . 988
,, Java, . . . 539
,, Malayan Peninsula, . 489
,, Mauritius, . . 781
,, New Zealand, . . 571
,, Seychelles, . . 723
,, Tasmania, . . 568
,, Tonkin, . . . 500
,, Trinidad, . . . 925
,, relation to altitude, 88, 203, 284, 868
,, ,, to climate, 129, 143, 559, 571, 649
,, ,, to density of population, 24, 88, 140, 861
,, ,, to race, 564, 861, 874
,, remittent, in
,, Brazil, . . . 963
,, Trinidad, . . . 924
,, seasonal distribution of, in
,, England, . . . 130
,, India, . . . 454
,, Italy, . . . 234
,, Norway, . . . 24
,, United States, . . 870
,, summary and review of facts concerning, 860–870
Ponos, ... 241
Purpura Hæmorrhagica, 111, 150, 171, 267, 359, 493, 908

Radesyge, endemic syphilis of Norway, ... 26
Remittent Fever (non-malarial), 107, 817
,, mortality from, in Scotland, . . 138
Respiratory Diseases, distribution of, in
,, Canada, . 795
,, France, . 188
,, India, . 450–452
,, Sweden, . 39
Rheumatic Affections, prevalence of, in
,, Aden, . 287
,, Africa (East Central), 693
,, Arabia, . 284
,, Australia, 561
,, Canada, . 796
,, Canaries, . 705
,, Cape, . 657
,, Cayenne, . 939

PAGE
Rheumatic Affections, prevalence of, in
,, Ceylon, 477
,, Chili, . 976
,, Gaboon, . 640
,, Gold Coast, 634
,, Greenland, 790
,, Guiana, . 939
,, Iceland, . 11
,, India, . 459
,, Ireland, . 144
,, Jamaica, . 910
,, Japan, . 523
,, Matebeleland, . 661
,, Sumatra, . 527
,, Tunis, . 597
,, United States, . 871
,, Valparaiso, 976
Rheumatic Fever, mortality from, in
,, Australia, . 561
,, Cape Verde Islands, . . 706
,, England, . 133
,, Ireland, . . 144
,, Italy, . . 235
,, New Zealand, . 572
,, Switzerland, . 189
common in
,, Alaska, . . 790
,, Bechuanaland, . 664
,, Egypt, . . 604
,, Iceland, . . 11
,, Ireland, . . 144
,, Mexico (tableland), . . 882
,, New Caledonia, 576
,, Senegal, . . 620
,, rare in the
,, Falkland Islands, 988
,, Gold Coast, . 634
,, Persia, . . 296
,, Vera Cruz, . 880
,, seasonal prevalence of, in
,, England, . . 133
,, Norway, . . 25
Rickets, mortality from, in England, 135
,, prevalent in Syria, . . 277
,, rare in
,, Australia, ... 560
,, Java, ... 540
,, Persia, ... 296
,, Senegal, ... 620
,, said to be excessively prevalent in Ceylon, . 477
Ringworm prevalent in New Guinea, 547
River Fever, remittent fever of Niger, 638

St. Kilda Boat Cough, . . . 140
Sakith-blah, perforating ulcer of foot, 529
Scarlet Fever, in
,, Abyssinia, . . 697
,, Albania, . . 237

PAGE
Scarlet Fever, in
,, Algeria, . . 594
,, Australia, . . 558
,, Bechuanaland, . 663
,, Brazil, . . . 963
,, Cape, . . . 655
,, Ceylon, . . 474
,, China, . . . 511
,, England, . . 121
,, France, . . 179
,, India, . . . 445
,, Iceland, . . 10
,, Italy, . . . 232
,, Japan, . . . 523
,, Montenegro, . 237
,, Norway, . . 19
,, Samara, . . 60
,, Sweden, . . 39
,, Syria, . . . 277
,, Teheran, . . 296
,, Trinidad, . . 924
,, Tunis, . . . 597
,, United States, . 846
,, introduced into
,, Australia, . . 558
,, Chili, . . . 975
,, seasonal prevalence of, in
,, Austro-Hungary, . 100
,, England, . . 121
,, United States, . 846
,, towns in Germany that have escaped, 84
,, unknown in
,, Africa (East Central), 692
,, ,, (East Coast), 675
,, Faröe Islands, . 12
,, Fiji, . . . 575
,, Greenland, . . 789
,, Java, . . . 539
,, St. Helena, . . 708
,, Senegal, . . 620
,, Sumatra, . . 527
,, Tonkin, . . 499
,, Zanzibar, . . 710
Scrofula, geographical distribution of, in
,, Arabia, . . . 284
,, Austria, . . . 102
,, Cape, ... 658
,, England, . . . 134
,, France, . . . 181
,, Germany, . . . 90
,, Italy, ... 235
,, Siberia, . . . 251
,, Spain, ... 204
,, Switzerland, . . 190
,, prevalence of, in
,, Abyssinia, . . . 697
,, Alaska, . . . 789
,, Argentina, . . . 987
,, Asia Minor, . . 274
,, Australia (Aborigines), 546
,, Balkan Peninsula, . 245
,, Ceylon, . . . 477
,, China, ... 512
,, Egypt, . . . 604

PAGE
Scrofula, prevalence of, in
,, Fiji, ... 575
,, Loango, ... 640
,, Malayan Peninsula, . 489
,, Morocco, ... 587
,, New Caledonia, . . 576
,, New Zealand (Aborigines), . . . 573
,, Sandwich Islands, . 579
,, Society Islands, . . 578
,, Sumatra, ... 527
,, United States, . . 872
,, rare in
,, Cayenne, ... 939
,, Faröe Islands, . . 13
,, Greenland, . . . 789
,, Madeira, ... 703
,, Mexico (table-land), . 881
,, Persia, ... 296
Scurvy, India, ... 461
Smallpox, introduced into
,, Alaska, ... 789
,, Australia, . . 558, 562
,, Bechuanaland, . . 662
,, Cape, ... 655
,, Faröe Islands, . . 12
,, Greenland, . . . 789
,, Iceland, ... 9
,, Mauritius, . . . 780
,, New Caledonia, . . 576
,, Siberia, ... 251
,, prevalence of, in
,, Abyssinia, . . . 697
,, Africa (East Central), . 691
,, ,, (East Coast), . 675
,, Algeria, ... 594
,, Arabia, ... 284
,, Austro-Hungary, . . 100
,, China, ... 510
,, Cuba, ... 901
,, Egypt, ... 604
,, England, ... 125
,, France, ... 179
,, Germany, ... 84
,, India, ... 443
,, Italy, ... 233
,, Japan, ... 523
,, Khiva, ... 253
,, Loango, ... 640
,, Madagascar, . . . 719
,, Mauritius, . . . 780
,, Mesopotamia, . . . 280
,, Norway, ... 19
,, Persia, ... 296
,, Senegal, ... 620
,, Sierra Leone, . . . 634
,, Spain, ... 202
,, Tahiti, ... 577
,, Tasmania, ... 567
,, Tonkin, ... 499
,, seasonal prevalence of, in
,, England, ... 125
,, Germany, ... 84
,, India, ... 444
,, Italy, ... 233
,, Sweden, ... 39

PAGE
Spirokolon, endemic syphilis of Greece, ... 241
Spleen, diseases of, in
,, Ceylon, ... 473
,, China, . . . 506, 507
,, Cuba, ... 897
,, Hungary, ... 101
,, India, ... 458
,, Lampongs, ... 526
,, Madagascar, . . . 714
,, enlargement of, in marshy, but non-malarious locality
,, Chiloe group, . . . 975
,, rare in
,, England, ... 133
,, Iceland, ... 10
,, Sierra Leone, . . . 624
Sprue, in Hong-Kong, . . . 518
,, Malayan Peninsula, . . 489
Suakin Fever, description of, . . 601
Summaries of facts concerning
Beriberi, ... 535
Cholera, ... 418–441
Dysentery, ... 689–691
Fever, Enteric, . 115–118, 397–411
,, Yellow, ... 897–900
Influenza, ... 946–961
Phthisis, ... 845–855
Pneumonia, ... 860–870
Syphilis, ... 984–987
Syphilis, endemic in
,, Abyssinia, ... 697
,, Arabia, ... 284
,, Bohemia, ... 102
,, Greece, ... 241
,, Lithuania, ... 54
,, Madagascar, . . . 720
,, Norway, ... 25
,, Ottawa, ... 797
,, Roumania, ... 245
,, Sumatra, ... 527
,, Zanzibar, ... 710
,, prevalence of, in
,, Abyssinia, ... 697
,, Africa (East Central), . 693
,, Argentina, ... 984
,, Bechuanaland, . . . 663
,, Brazil, ... 964
,, Canada, ... 796
,, Ceylon, ... 477
,, Chili, ... 976
,, China, ... 511
,, Corea, ... 256
,, Egypt, ... 604
,, England, ... 135
,, Germany, ... 90
,, Gold Coast, . . . 634
,, Hong-Kong, . . . 519
,, India, ... 459
,, Italy, ... 235
,, Jamaica, ... 910
,, Japan, ... 524
,, Kamtschatka, . . . 251
,, Kirghiz Steppe, . . 251
,, Madeira, ... 703

PAGE
Syphilis, prevalence of, in
,, Morocco, ... 587
,, Paraguay, ... 984
,, Philippine Islands, . 546
,, Roumania, ... 245
,, Sandwich Islands, . 579
,, Society Islands, . . 579
,, Spain, ... 204
,, United States (Aborigines), . . . 874
,, Valparaiso, ... 967
,, rare in
,, Banca, ... 529
,, Billiton, ... 529
,, Faröe Islands, . . 13
,, Fiji, ... 575
,, Greenland, ... 790
,, Iceland, ... 11
,, amongst Samojeds, . 251
,, Zambesi (Upper), . . 693
,, summary and review, 984–987
,, unknown amongst
certain Indian tribes of
,, North America, . 874
,, South America, 964, 971, 984
,, natives of Chiem-Hoa (Upper Tonkin), . 500

Tabes Mesenterica, geographical distribution of,
in England, . 134
,, prevalence of, in
Italy, . . 235
Madeira, . 703
Seychelles, . 723
United States, 872
Tab-i-ghash, description of, . . 294

PAGE
Tænia, in Abyssinia, . . . 698
Tagœzen, in Java, ... 540
Trismus Neonatorum, in
,, Iceland, . 10
,, Senegal, . 621
,, United States, 871
Typhus du Bois, a form of jungle fever, ... 492

Ulcers, prevalence of, in
,, Africa (East Central), . 694
,, India, ... 461
,, Malayan Peninsula, . . 489
,, Zanzibar, ... 711

Venereal Diseases, prevalence of, in
,, Brazil, . . 964
,, Chili, . . 967
,, Egypt, . . 604
,, England, . 135
,, India, . . 459
,, Senegal, . . 621

Whooping Cough, prevalence of, in
,, Australia, . 556
,, Austria, . . 101
,, England, . 125
,, France, . . 177
,, Germany, . 85
,, Iceland, . . 9
,, Siberia, . . 251
,, Spain, . . 203
,, introduction of, into Labrador, 789

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